EDITORIAL

IT would seem almost as if some kind of a jinx was currently operating to upset the affairs of "Radio, Television and Hobbies."

In March last death claimed Editor John Moyle, and this tragic event necessitated a complete reorganisation of our staff and staff functions. Then, just as we seemed to be getting things straightened out, trouble struck again, this time at the undersigned.

Hurrying out into my garage, late one evening, in search of something to modify a pickup mounting, I turned more sharply than wisely on a damp concrete step—and landed in an ungainly heap. Half an hour later, sufficiently doped and splinted, I was carried off to hospital, there to learn that I would have to spend the next three months on the flat of my back.

What such a pronouncement does to one's peace of mind I need hardly say. Nor need I emphasise the load which will be thrust on the rest of our technical staff under Philip Watson. If one or two of our regular features, therefore, appear to be abbreviated or other changes have to be made, please understand that they are the result of an emergency and not of any policy of economy. You can rest assured that our basic policy is one of progress and expansion, and we intend to pursue it to the limit of our capacity.

One of the features which must perforce suffer some interruption is my review of "sacred" and "light" records, as opposed to the "classical" reviews contributed by Julian Russell. This is a personal disappointment because the two are complementary, and, together, give readers a good coverage of the records in which they are most likely to be interested. However, some important things remain to be said, by way of a general article, so that the space should not be entirely void.

In the meantime, I seem to be living in a world of muffled loudspeakers, transistor portables, and "top forty" tunes. And what a dreadful combination they make for those of us who, I understand, are described as "squares." Transistor portables are technically most intriguing for their compactness and economy, but they are quite unique in their ability to annoy those who don't like what they have to offer. All power to those who want to limit their use in circumstances where they annoy a dozen people for every one they "entertain."

I quote the word entertain, because it is a constant source of wonderment to me in the amount of time which many radio stations currently devote to wordy advertisements and to "pop" trivia about such things as the plight of a certain unfortunate kangaroo.

It is little wonder that, having had their fill of television for an evening, people turn not to radio, but to reading or to records. Personally, I'm counting the days till I can get off this hospital bed and "cut me turntable loose, boys, cut me turntable loose."

W. N. Williams

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RADIO ★★ TELEVISION AND HOBBIES

A NATIONAL MAGAZINE OF RADIO, TELEVISION HOBBIES AND POPULAR SCIENCE

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OUR COVER PICTURE

Speed! Fighter-bombers such as the U.S. F-105 Thunderchief cannot "drop" bombs against the pressure of a Mach II slipstream. Instead, they must force them out by means of a special "bomb dispenser." The one shown here being loaded into an F-105 can exert a thrust of 30,000 lb.

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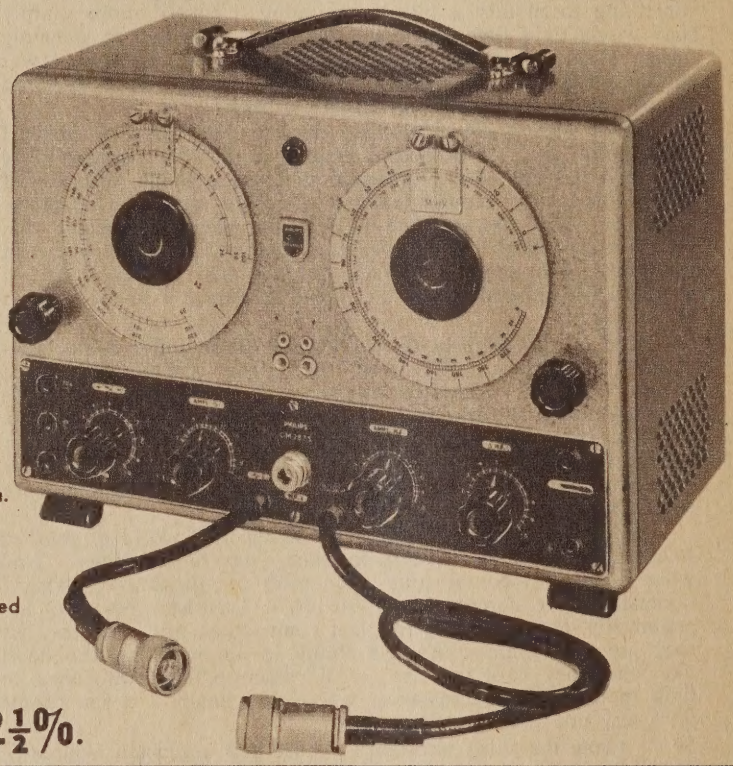
Television Sweep and Marker Generator

TYPE GM 2875

for fast accurate alignment



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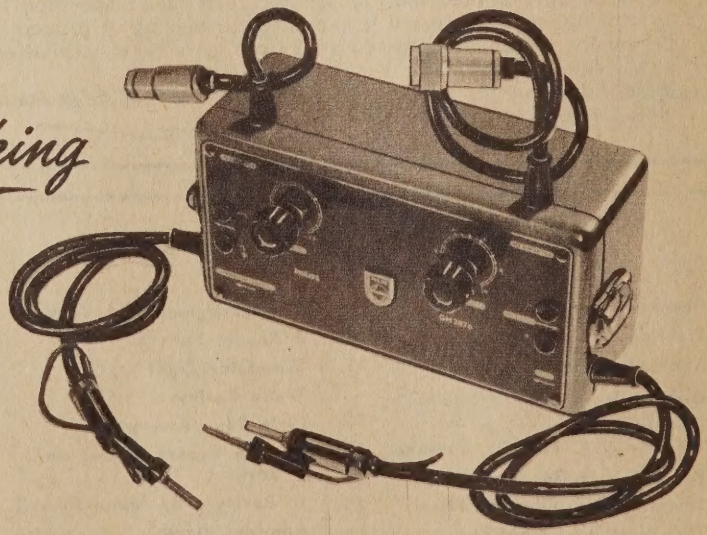
for constant amplitude marking



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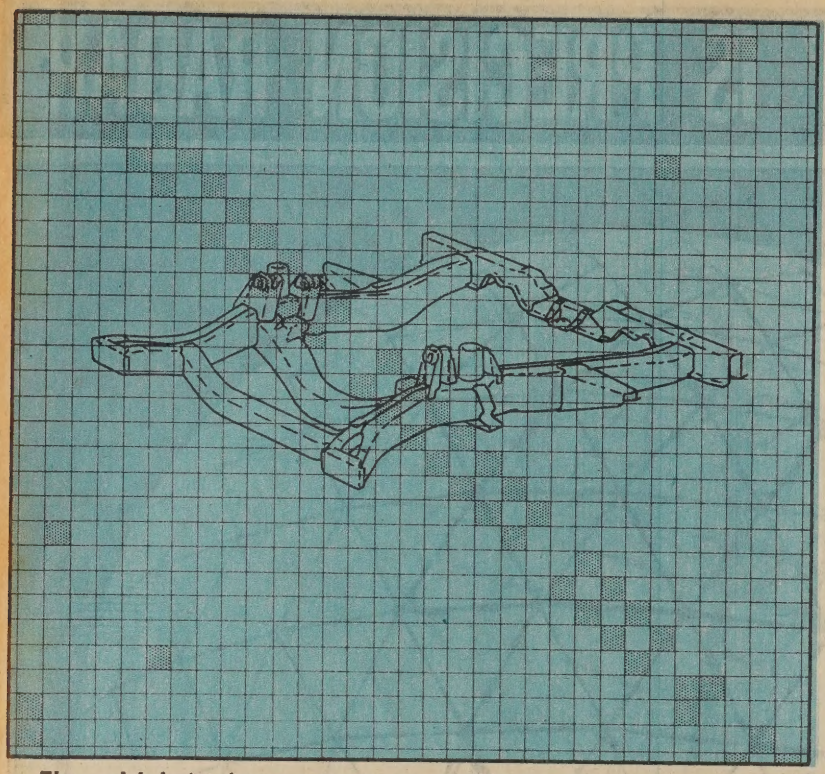
P2233/60

"LANTERN" IS PRECISION RADAR

Resembling an enormous Japanese lantern, this geodesic radome, mounted atop a new radar test tower, houses the reflector for a high power, multi-beam search radar system built by the General Electric Company (U.S.A.). The tower, known technically as a "radar antenna test pattern fixture," was recently erected to enable General Electric engineers to determine the degree of influence of a radome on the receiver it encloses. Though it weighs 60 tons and must be able to withstand wind velocities of up to 80 miles per hour, the fixture is actually a precision instrument, with only the slightest tolerances allowable in its operation.



The model depicted represents part of a stiffness matrix for the forestructure of a 1960 Chrysler Corporation car. Each horizontal strip symbolises six equations resolving the stiffness characteristics for a particular segment of the assembly. Each shaded box represents mass, stiffness, or damping values for that set of equations.

Fighting Car Noise With Electronics

The following article is a precis, prepared by the Editor, of an excellent information booklet released recently by the Engineering Division of the Chrysler Corporation. It tells how modern electronics is helping to beat the noise problem in modern cars.

WHAT does a car sound like that has received no silencing treatment? The clamour is difficult to imagine. Yet the energy of the noise produced by such a car represents only about a billionth of a horsepower. And this small but disturbing package of sound can come from parts which vibrate through a distance of less than a millionth of an inch.

Thus, the engineering changes required to remedy a noise may be small. The problem lies in knowing where and how to make the changes.

The first question that arises when silencing a car is "What is causing the various noises?" Almost any type of physical shock is apt to create vibrations and noise but the relationship between this shock and the noise you hear may be simple or it may be complex.

There are two sources of shake in an automobile—the road and the engine. The suspension allows the wheels to bounce independently of the car body. To accomplish this end, the suspension includes a spring at each wheel that can deflect when the wheel hits a bump.

NATURAL FREQUENCY

Now every suspension has a natural frequency. This means that a single blow to the wheel will cause the suspension alternately to compress and expand at a certain rate. When the car goes over a rough road the suspension will usually vibrate at this freqency.

Although the suspension may make the ride sufficiently smooth to suit the passengers some of the low-frequency suspension vibration will be transmitted to the car structure. After a while, this means rattle.

It is not surprising that the engine, too, is a major source of vibration. Consider the type of force the engine must generate to accelerate a two-ton vehicle from a standstill to a speed of 60 m.p.h. in a matter of seconds.

The same explosions that cause the engine to roar also shake the entire engine and transmission assembly. If this shake is conducted along the drive line to other parts of the car, it can indirectly cause a wide assortment of rattles and squeaks.

There are two causes of engine vibration. First, the successive firings set up a series of shocks all along the engine's length. In a V-8 this means four pulses for each crankshaft revolution. Engineers call this a **fourth order** vibration, meaning that the frequency will be four times engine speed.

Second, unbalance in the engine's rotating parts will cause a pulse for each crankshaft revolution. This is called a **first order** vibration. Thus, if engine speed is 80 revolutions per second, the first order vibration (unbalance) will be 80 cycles per second and its fourth order vibration (firings) will be 320 cycles per second.

SHAFT VIBRATION

There is one other type of vibration closely associated with the engine. This occurs in the propeller shaft. In most modern automobiles, the transmission and the propeller shaft join at an angle in the front universal joint.

Due to the non-uniform characteristic of a universal joint operating at an angle, any torque fed into the propeller shaft will induce a **second order** vibration in the drive train. This vibration will always be twice the propeller shaft speed. The frequency of the second order drive train vibration relative to engine speed will depend upon the effective gear ratio.

Although the control of vibration is the engineer's toughest task, he must still guard against the more direct causes of noise. These can include the wind, gears in mesh, grumpy brake linings, power steering pumps and thumpy tyres.

In the development stages of a new model, virtually every noise should be reduced as much as possible, though greatest emphasis must be given to the more annoying noises.

The most obvious approach is for the engineer to take a ride in a prototype model and simply listen. The best place to do this is at the proving grounds where a wide variety of actual road conditions is simulated. At the same time the sound level is also measured by a meter.

Once the sound problems have been identified, the various noises must be evaluated for degree of annoyance.

The human ear is the final arbiter for evaluation because that is how the customer judges the car. Often several engineers ride together and this "jury" collaborates to bring in a verdict.

But there are human factors which prevent assigning an absolute rating to a car or any component part of it. First, it is very difficult to remember and evaluate the many parts of a complex noise. Also, the mind has a difficult time

recalling relative sound levels. Physical fatigue affects the ratings by any one person and further, the ear nerves become partially paralysed after exposure to fairly intense sounds.

For best comparison, any change in sound should be immediate. This is done by making tape recordings of the "live" runs and then combining the sounds on a single tape to play back—one after the other.

After the sounds of an automobile have been measured and analysed, they must be traced to the parts producing the noises. This is not always an easy task. As one engineer expressed it, "a car is the perfect ventriloquist."

Various elaborate "listening systems" are used to pinpoint the location of a noise. Some of these employ the principles of stereophonics. They help identify the noisy part; they do not always reveal the cause of the noise.

FREQUENCY METERS

For this, frequency meters are valuable. With the aid of a frequency meter, a noise occurring only at certain engine speeds could be traced to a first order (engine unbalance), second order (propeller shaft universal joint), or fourth order (engine firings) vibration.

Once a part has been tagged as a noise producer, the silencing treatment begins. This work has two aspects. First, everything possible is done to reduce the noise at its source. Following this, secondary methods are employed to prevent the passage of noise into the passenger compartment or to absorb any that gets there.

The six basic methods of silencing are: Reduction of noise at the source, isolation, damping, resonance tuning, insulation, and absorption.

Reducing noise at its source may simply involve the tightening of a loose part or the stiffening of a vibrating component. On the other hand, the part may have to be redesigned. Sometimes, merely changing its sound quality is adequate.

Isolation merely means confining vibrations to the originating parts. Thus, an electric fan may require a felt pad on its mounting surface. This is isolation.

Modern rubber engine mounts are another good example. They allow the engine to vibrate, but the rubber isolates these vibrations from the passenger compartment. However, all lines of direct contact between the engine (and transmission) and the passenger compartment must be similarly isolated to prevent acoustic "short circuits."

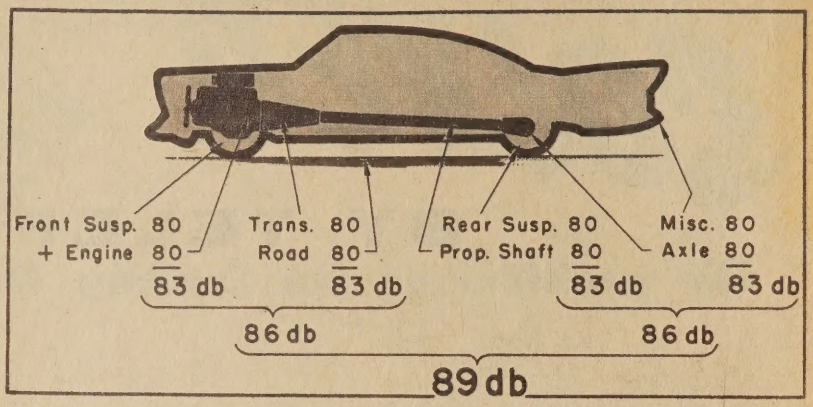
FLUID DEADENERS

Damping: Any treatment reducing the intensity of vibrations will make a car quieter. Certain materials are helpful in accomplishing this. Heavy, tar-like materials called fluid deadeners are applied to metal panels to "damp" their vibrations—that is, to reduce intensity by absorbing energy.

Resonant Tuning is similar to damping. If a low frequency noise has a fairly constant pitch, a "resonance chamber" may be used to cancel it. An example is the air-intake silencer on an engine. Air gulped by the carburettor produces a very loud noise.

When an air cleaner with a carefully designed resonance chamber is used, the air molecules in the chamber "zig" while those in the carburettor "zag." These opposing vibrations tend to neutralise each other to eliminate the noise.

THE DILEMMA OF THE DECIBEL



Because our ears automatically become more sensitive as noise level is decreased, very substantial improvements are necessary before any great audible difference is apparent.

Resonant tuning of another sort is possible with body panels. If a major panel resonates with a drive-line or road-induced vibration, a minor vibration can be magnified into a major drumming noise. Changing the resonant frequency of the panel eliminates the drumming. This is done by changing the panel's mass or stiffness. Thus, we can tune panels to avoid vibrations known to exist in the car.

INSULATING MATERIALS

Insulation is any physical barrier to **airborne** vibrations. Contrary to what many people believe, good sound insulating material should be heavy and dense rather than soft and porous. In fact, the effectiveness of an insulating material is almost directly dependent upon its weight per volume. A multiwall or laminated construction is also helpful.

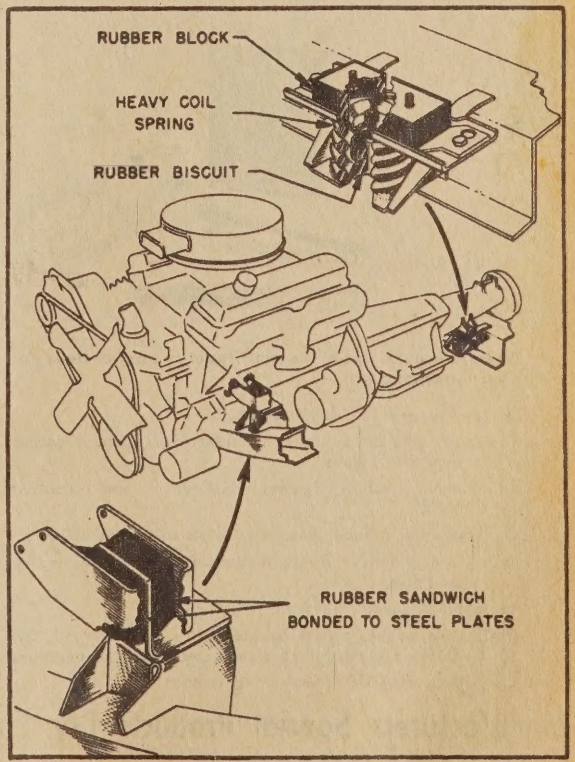
Absorption: After everything possible has been done to reduce noise, absorption remains the final step. Unlike insulators, good absorbers should be soft and porous. Porous materials have a great deal of surface against which moving molecules glance. By absorbing the energy of these molecules, they reduce the intensity of the sound.

Regardless of the type of sound reduction used, the silencing engineer always faces one serious handicap — the ability of the human ear to increase sensitivity for weaker sounds.

How this affects sound reduction can be illustrated by the example shown. Here, we have arbitrarily assumed that the total noise of a car can be neatly divided into eight equal segments, each noise with a different source. If we assign each segment a noise value of 80 decibels, the combined noise level will be 89 decibels. (Remember that decibels are logarithmic and cannot be added directly. Whenever two equal noises are combined, the decibel increase is always 3.)

Now let us assume that the driver finds this 89 db to be intolerable and wants the apparent loudness cut in half.

Now if our silencing engineer completely eliminates all engine, front suspension, transmission, and road noise



☆

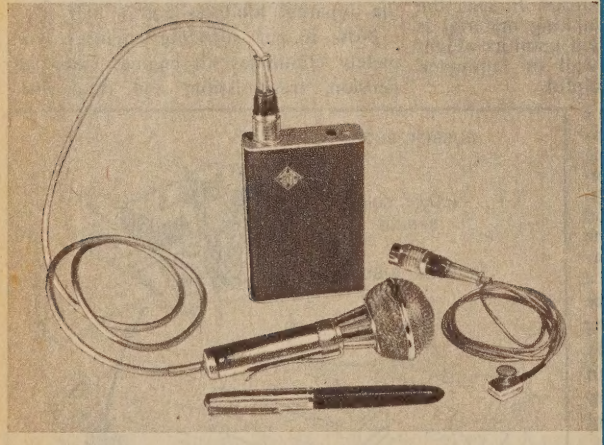
The design of the engine mounts as illustrated is more than a whim. It is intended to achieve a definite order of mechanical resonance.

☆

SOLVED BY TELEFUNKEN

The problem of the Trailing Microphone Lead

The Telefunken "Mikroport" Cordless Microphone



Some examples from the multitude of applications for the "MIKROPORT".

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The receiver output is fed into any audio channel or public address amplifier. The very effective AGC circuit ensures a constant output level regardless of any movement by the person wearing the microphone.

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Price of one System, including Transmitter, Receiver and both Microphones, £226/10/- (including Duty and Sales Tax).

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TRANSMITTER:
Completely Transistorised Carrier Frequency: 36.7 and 37.1 mc/s. F.M.
Total Distortion: Less than 2%.
Antenna: Inbuilt.
Battery: E.R. type 412 gives 10 hours' operation.
Total Weight: 6 ounces.

HAND MICROPHONE:
Frequency Response: 100 to 12,000 c/s. ± 3db.
Directional Characteristic: Cardioid, 15db front to rear ratio.
Weight: 3 ounces.

LAPEL MICROPHONE:
Frequency Response: 400 to 4,000 c/s. ± 4db.
Omni Directional.
Weight: ¼ ounce.

RECEIVER:
Output Voltage: 1.55 volts.
Rated Load Impedance: 1,000 ohms.
Audio Frequency Response: 100 to 15,000 c/s. ± 2db.
Total Distortion: Less than 2%.
Mains Supply: 240 volts A.C.
Built-in monitor speaker and magic-eye tuning and deviation indicator.

For mobile use, an inverter can be supplied to allow operation from a 6 or 12-volt accumulator.

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from our hypothetical car (a remarkable feat), he has removed half of the original eight noise packages. However, he has reduced the sound intensity by only 3 db (89 to 86).

His next step may be to eliminate all propeller shaft and rear suspension noise. This reduces intensity by another 3 db to 83 db. This is still too loud.

Finally, he may eliminate all of the miscellaneous noise and thereby reduce the sound intensity to the required 80 db. The total reduction of 9 db (89 to 80) has cut the loudness by half. Note, however, that he had to eliminate 7 out of 8 equal noise packages to effect this reduction.

In other words, our car with only a noisy axle seems fully half as loud to the driver as the original car with the equivalent of eight noisy axles!

TRICKY PROBLEM

This is one of the things that makes sound reduction so difficult. Since it is a "built-in" characteristic of the human ear, the silencing engineer has no choice but to comply.

From the foregoing, it is clear that sound reduction is not an efficient way to achieve a quiet car. It would be much better to start with an inherently quiet design and thereby ease the need for sound reduction.

This brings us to one very practical problem in planning and designing the modern automobile . . . the question of time. It normally takes three or four years to develop an automobile from the stylist's rendering to the day it first moves down the production line. During this period, the manufacturer becomes increasingly committed to basic design decisions.

To greatly influence the design of a car, the silencing engineer should follow it from its earliest inception. Unfortunately, inherent quietness is very difficult to appraise in these early design stages, for an automobile as a noisemaker is incredibly complex.

Therefore, to accurately predict the inherent quietness of a given design, the silencing engineer must have an exact understanding of countless variables and he must somehow be able to correlate all these variables.

NEW APPROACH

Until now, this has not been possible. The traditional approach has been to hand-build prototype models identical to the pending production cars and test them. Since the prototype had to be similar to actual production, however, it could not be built until all major design decisions were firm.

This seriously limited the time available to the silencing engineer. The type of change he could recommend, at this late date, was limited to those that would not involve wholesale scrapping of tooling.

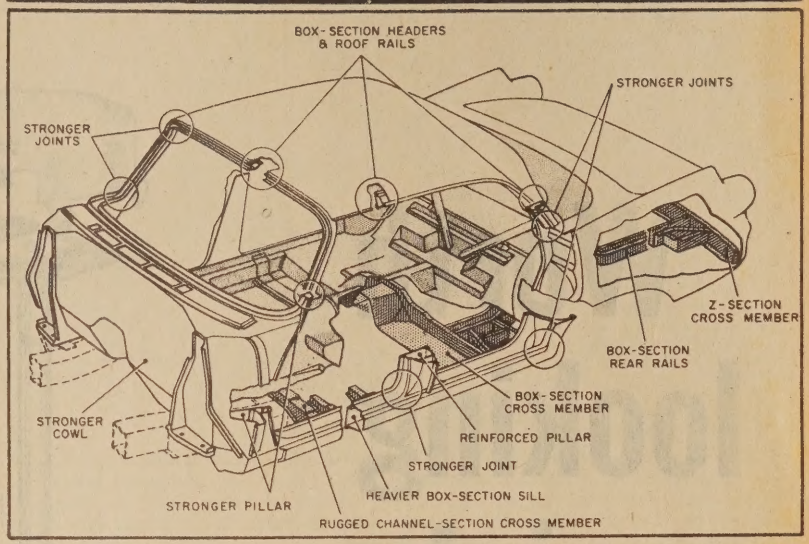
As a climax to many years of intensive research into this whole problem, Chrysler Corporation engineers have made very notable advances.

Firstly, using scale models and mathematics, they can predict the characteristics of a given design while it is still in its very early development stage.

Secondly, laboratory techniques have been developed which streamline the secondary processes of sound reduction on the already proven design.

In bringing science to basic design, Chrysler Corporation turned first to "the purest branch of science"—mathematics.

BODIES ARE QUIETER, STRONGER



The Chrysler Corporation is proud of its "Unibody" structure, the product of research using maths., models and electronics.

They checked the universities, the research centres, technical texts and publications. It meant investigating engineering and scientific advances in this country and abroad. They found the key to the riddle in the highly developed aircraft and missile industry. An automobile is not, of course, an aeroplane or rocket. The new theory had to be modified and developed before it was suitable for automotive research.

Once the system was tailored to automotive needs, Chrysler Corporation engineers began to construct a "mathematical model" of the automobile. This model was composed entirely of numbers and equations, precisely representing a car as a functioning unit. More technically, the mathematical model is a matrix representation of a structure that mathematically correlates its various masses and stiffnesses. The model can apply to an entire structure or some segment of it.

For example, the model illustrated at the head of the article represents the engine-supporting forestructure for one of the 1960 cars. This particular model is a matrix of 360 distinct equations.

It is one thing to accurately resolve a complex automobile in terms of equations to form a mathematic model. It is quite another thing to solve those equations in time to do any good.

COMPUTER

Fortunately, there is now a way to speed things up. The science that spawned the new theories has also given us the very tool to apply these theories . . . the electronic computer. The major virtue of the modern electronic computer is its remarkable ability to solve equations — accurately and with lightning speed.

The "mathematical model" is still being developed. At present it encompasses the major elements of the automobile, particularly the engine and drive line. It does not as yet reflect the structure in as much detail, because the structure is much more complicated.

In the meantime, Chrysler Corporation engineers wanted a streamlined approach to basic body design to supplement the computer programs. The traditional technique of building and testing full-sized steel replicas of proposed car structures was inadequate.

But what if some other material could be made to act like steel, without these disadvantages? In their search, Chrysler Corporation turned to yet another rapidly growing field—the plastics industry.

After months of search, the engineers found a plastic that could be used in a ⅜ scale model to simulate steel in a full-sized model. The next step was to devise a method of fabrication that would work the plastic in the same way that heavy presses work actual steel at stamping plants. And, since the plastic model was a reduced scale version in strength as well as size, it required special test equipment that was proportionally more sensitive. This, too, had to be developed.

ADVANTAGE

The most important advantage of the plastic model is in its very plasticity, a quality that permits a much greater scope in testing than was possible with steel. The plastic model allows researchers to go well beyond the yield point of steel to dramatise weaknesses without damaging the model.

The reduced scale of the plastic model also makes it more convenient to handle. And the plastic model is transparent. Engineers can actually see what happens under load conditions in a way not possible with steel.

To trouble-shoot sounds and vibrations in prototype models, Chrysler Corporation recently invested more than half a million dollars in an amazing electronic highway. This new facility is a highly specialised, nine-room laboratory that forms a nerve centre for sound and vibration testing and development. Here also is to be found the world's most elaborate collection of "hi-fi" equipment.

A drive-train analyser room is the nucleus of this facility. Here, a car is positioned over a well-lighted pit from

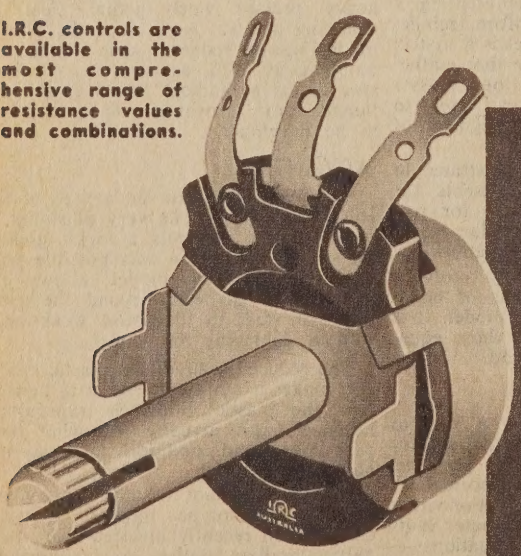
Worth looking into . . .

Here are the reasons why I.R.C. Type "Q" Miniature Controls have achieved the highest reputation for silent performance and long life.

All the important features outlined on the exploded view of the "Q" Control are the result of years of intensive research into Volume Control operation and are combined to ensure a soundness of design and construction that makes the I.R.C. "Q" Type Control the best of its type available.

Cadmium plated steel passivated cover.
Dual finger contactor that ensures minimum contact resistance.
Silver plated terminal fixing rivets.
One piece collector ring and terminals silver plated to ensure silent operation.
Smooth, high grade resistance element.
Precision moulded base of moisture - resistant bakelite featuring recesses for correct alignment of parts and firm fastening of terminals.

I.R.C. controls are available in the most comprehensive range of resistance values and combinations.



IRC AUSTRALIA

Type Q

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126 Sussex Street, Sydney. BX 1131

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which engineers can view the underbody. Engine power output is fed into giant, twin 250-horsepower dynamometers, so that the rear wheels remain stationary.

The brain for this room is a 14-foot ceiling-to-floor console covering one wall and incorporating scores of dials and meters, more than 100 signal lights, and a mile of wiring. In this room, a car can be analysed for all types of engine and drive load conditions completely independent of road conditions.

Vibrations are supplied by a team of magnetic shakers, while frequencies are controlled by a special signal generator. These shakers can introduce a vibration at any point of the car. They can work in or out of phase with each other. They are powerful enough to rock an entire automobile, or they can introduce vibrations so fine as to be invisible to the naked eye.

ELECTRONIC PROBES

Electronic probes are used during the test to pick up all of the car's hidden rumbles. Sometimes these probes are coupled to vibration meters that can reveal vibrations of only one ten-thousandth of an inch. At other times, they feed into magnetic tape recorders so that their findings can be relayed directly into electronic computers.

The key advantage of this centre is its ability to duplicate any road or drive train situation with a mere twisting of dials. Here is obtained the precision and control possible only in a laboratory. There is no test driver, no human variable, to cloud comparative analyses of different designs.

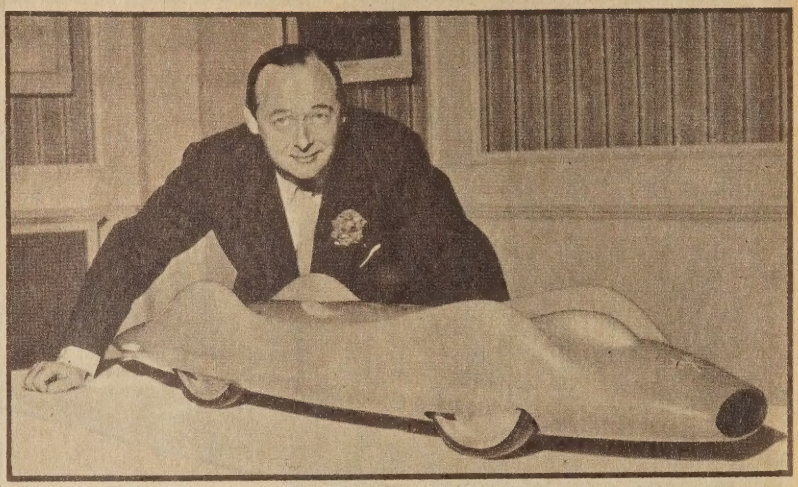
Another interesting technique is made possible by this approach. For this experiment, the entire passenger compartment of the car is forced to breath like a giant lung. First, the car is completely sealed with all windows up and made air-tight. Next, a hole is cut into a door window. Then, a cylindrical platen driven by a magnetic shaker is fitted in this hole. When the platen is vibrated, all the air trapped in the car is alternately compressed and expanded at the same frequency. This, in turn, causes all of the surrounding car surfaces to vibrate at this frequency. Probes exploring the outer surfaces of the car then reveal the resonant frequencies of the various body panels.

PROBLEMS AHEAD

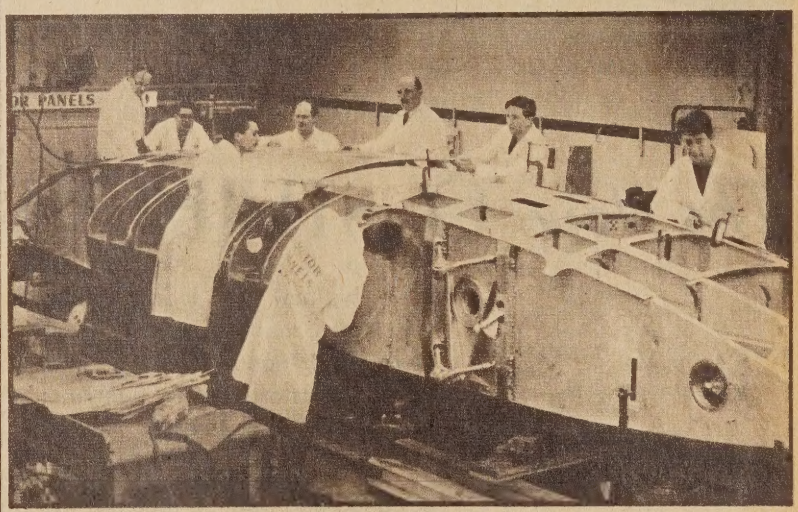
Now we come to the end of our story. We have touched upon some of the problems of silencing the modern automobile. We have seen how the silencing engineer approaches these problems and what new ideas he has developed in the fight against noise . . . the fight to bring the customer a quieter car that will stay that way.

It is not yet time, however, to retire our silencing engineers to bask in the sunshine of their achievements. An important victory has been won, but the war is never-ending. No two vehicles are exactly alike in design; no two are exactly alike in noise problems. And car design is constantly evolving as improvements are developed. Nor have the limits of understanding been reached for even a single design. Even as you read these words, a punchcard bank of information is steadily growing . . . ready to supply the key answers to tomorrow's problems.

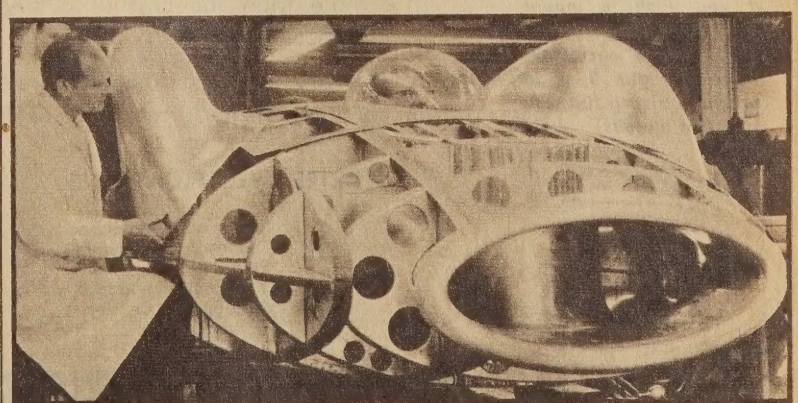
"BLUEBIRD" TO ATTACK RECORD



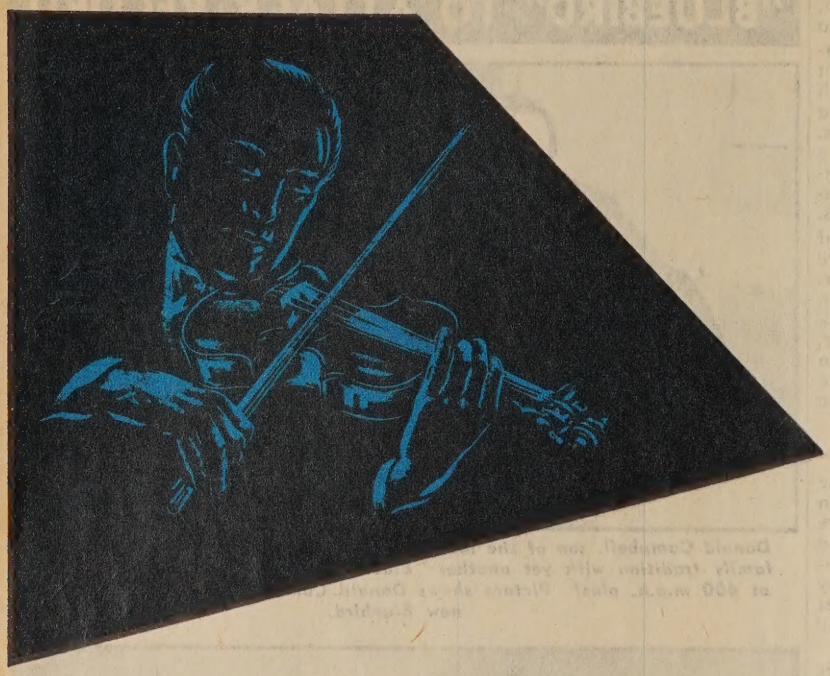
Donald Campbell, son of the late Sir Malcolm Campbell, is carrying on the family tradition with yet another "Bluebird" racing car—this time aimed at 400 m.p.h. plus! Picture shows Donald Campbell with a model of the new Bluebird.

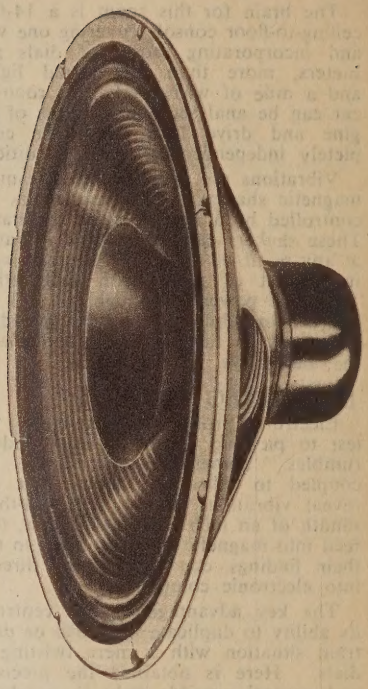


This picture shows the frame of the new Bluebird under construction, with the four longitudinal members which form the basic structure. They are made of light alloy "honeycomb" sandwich. The design is the result of five years planning in co-operation with 69 leading British companies.



Here, one of the wheel cowlings (left) is being fitted on to the frame. The huge air intake in the nose is to feed a Proteus gas turbine motor, which needs neither clutch nor gearbox. The engine can deliver full power output within one minute of starting up, and can be shut down just as quickly. The attempt on the record is to be made in Utah, U.S.A. next September. Present record, by the late John Cobb, is 394.196 m.p.h





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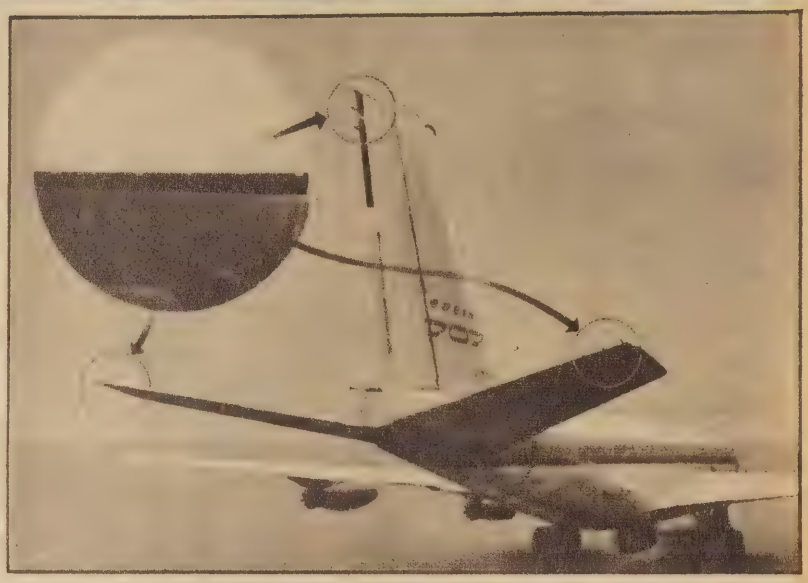
RE5

AIRCRAFT STATIC—A PROBLEM

Most people have had the experience of sliding across a plastic-covered automobile seat and receiving an unpleasant shock on grasping the door handle. The phenomenon causing the shock is called triboelectric charging, and it is responsible for a serious form of radio interference that occurs in aircraft flying through snow or clouds of ice particles.

In sliding across the seat cover, electrons are removed from the clothing and remain on the plastic, leaving the individual positively charged and the seat cover negatively charged. In an analogous fashion, when the ice crystals composing the snow or clouds rebound from the aircraft, electrons are removed from them and remain on the airplane. Each impact thus leaves a minute negative charge. The cumulative effect of millions of such impacts is to cause the aircraft to become quickly charged to a voltage so high that corona discharges (sometimes called St. Elmo's Fire) occur at the wing tips and other sharp extremities.



The now familiar Boeing 707 with the static dischargers fitted to the rear edge of the tail surfaces. The insert shows details of the discharge devices. Some of the tests have been conducted by Qantas Airways.

DISCHARGE PULSES

The corona discharges occur as a series of short-lived pulses, each of which acts as a tiny, broad band radio transmitter. The waves generated by the pulses travel about the aircraft, guided by the metallic surfaces, and enter the radio antennas. The result in the receiver is noise, known as precipitation static. This noise is frequently severe enough to impair seriously the functioning of radio receivers and navigation equipment.

To prevent the airplane from becoming charged when flying through solid-particle precipitation is impossible. It is also impossible to prevent the noise producing corona discharges from occcurring.

To eliminate the radio interference, therefore, the only avenue appeared to be to allow the discharges to occur but to prevent the noise generated by them from reaching the radio antennas.

This has been done. Special discharge devices have been designed by the electromagnetic sciences group which incorporate a sharp tungsten pin supported by a resistively coated plastic element for attachment at all points on the aircraft at which the discharges occur.

A typical discharge device consists of a nylon rod about the size of a lead pencil, with the tungsten pin crosswise through it at a very carefully determined location (about an inch) from the outer end. The nylon rod is coated with paint having the proper electrical resistance.

By choice of element shape and resistance, the device eliminates the coupling between the discharges and the airframe propagation paths that guide the disturbances to the antenna. One way of viewing this decoupling is that two alternate paths are provided so that noise propagated along one path cancels that propagated along the other.

With several of these discharge rods placed at locations on the wings, tail cone, and tail surfaces where discharges otherwise would occur, the precipitation-static noise becomes undetectable in the radio. On a test conducted in co-operation with the Boeing Aircraft Company on a 707 during severe precipitation static conditions, triboelectricity was discharged at a rate of three milliamperes without noticeable radio interference. In normal flights, the discharge is less than a milliampere.

The famous aerobatic team, "The Black Arrows", of No. 111 Squadron R.A.F. Fighter Command, famed for their close formation aerobatics in Hunter F Mk. 6 jet fighters, are shown here rehearsing for one of their many displays. The latest addition to the team is a Victor B Mk. 1 V Bomber, with a tail unit nearly as large as the Hunter's wing span.

JET-CAUSED STATIC

These static discharges are also effective in carrying off charges created by jet-engine exhausts. While the static from this source is generally less than from precipitation, it is particularly troublesome because it is worse during the throttle changes that occur during landing — when need for good radio communication is particularly critical.

This basic problem of precipitation static has been under study for the U.S. Air Force. A study of application of this static-elimination measure on military aircraft is being made. Service tests on commercial Boeing 707 jet planes is being made by Qantas Airways. It is planned that these dischargers will be standard equipment on future 707s.

Something like six million cubic miles of ice covers Antarctica, with a mass sufficient to disturb the earth's balanced rotation.

Is Polar Ice Moving The World's Crust?

It seems a strange anomaly that, in a universe consisting of millions of stars and large numbers of planets, scientists seem to know relatively more about the development of these than of our planet Earth.

by Calvin Walters

OVER the centuries, scientists have probed the interior of the earth, as far as humanly possible. They have sunk bores, descended down extinct volcanoes, carried instruments down mine shafts. They have studied rocks and strata and sediments, dug up and examined fossils, probed the ocean bottoms and tried to reconstruct the histories of mountains. They have set up instruments to measure gravity under all kinds of conditions.

Chemists have analysed, physicists have "physicised," geologists have "geologised," meteorologists have . . . (I can't bother with that one).

MANY APPROACHES

The earth's magnetic field has been studied in all sorts of ways; men have risked their lives in balloons and other devices. The net result is that we still know very little about the origin of the earth and how it works.

There have been many theories over the centuries about almost everything. These have been discarded one after another. What appears true today is discarded tomorrow. It would appear that the number of theories, which can be made to appear to fit the facts, are almost without number.

The origin of the earth is one of the great mysteries which has troubled scientists for centuries. It has caused more nervous breakdowns than an interfering mother-in-law.

The theory which held sway until 30 or 40 years ago was called the nebular theory. This maintained that the earth was originally nothing more nor less than a hot gas. It was "without form and void" to use a Biblical expression.

This hot gas gradually cooled and contracted, finally settling into a solid, similar to what we know of it today.

Then a new theory came up, which has made scientists somewhat sceptical about the old one.

This new idea has it that the earth started out as a very small, cold body, a planetesimal. This attracted to itself smaller particles such as meteorites and dust, finally growing to its present size by accretion. The heat of the earth could have developed by the friction of the collision, together with the internal pressures set up by the ever-increasing mass and the heat of radioactive particles gathered up during the movement through space.

Quite a number of geologists, geophysicists and others associated with the matter are leaning on this theory at the present time. How long it will hold them up is a matter for the future. At the present time, neither theory has been established.

This fact must lead to only one conclusion. Either the earth started as a gas, a liquid or a solid. No proof of any of these has been established. We must then conclude, as the most simple of simpletons must conclude, that scientists don't know much about it and the origin of the earth has not been explained.

THE ICE AGES?

However, it still gives the scientist something to work at and me something to write about!

Now, notwithstanding the failure of the scientist to explain the earth's origin, there are other matters relating to the earth which have engaged their thought. What caused the ice ages and the variations of climate throughout history? What caused mountains and ocean basins? How were continents formed? What causes volcanoes? Why are fossils of warm climate plants and animals found in polar regions? Why is warm climate coral found in the polar areas?

Before we get further into the matter, it would be as well to outline what scientists think they know at present, concerning the structure of the earth.

Notwithstanding anything I have stated in previous articles, the earth has a very thin solid crust—or is believed to have. I might have said something else previously, but you must remember that what I say in these articles are not things I have found out myself. They are only statements of beliefs held by scientists at the time of writing.

Having now "covered up" for myself, I repeat: The earth is believed to have only a very thin solid crust. This crust is from 20 to 40 miles thick.

WEAK CRUST

There is no really great strength in the crust, for it consists of rather fragile crystalline rock, which has become fractured in many places.

Below this crust is the substratum. This is thought to consist of an extremely hot plastic rock which will yield under pressure. It is therefore rather weak. It is upon this weak plastic mass that the continents and the whole crust of the earth rests. What is below this plastic mass is no concern of ours, as far as this article is concerned.

CRUST FAULT MAKES MOUNTAINS

Another thing, which we should remember for our present purpose, is that the earth revolves on its axis and that this axis is tilted. In addition, the South Pole or Antarctica is a large continent about twice the size of the United States of America, almost entirely covered with ice averaging one mile in thickness and up to two miles in places. It has been estimated that there are something like six million cubic miles of ice covering Antarctica.

This creates an enormous burden at the earth's southern pole.

The ice at the north pole is a fairly thin floating sheet by comparison and can have no effect on the earth's rotation.

MASS INCREASING

There is evidence that the ice at the South Pole is growing in mass and that it is not placed concentrically round the earth's axis. As regards the earth's rotation it is known that there is a slight wobble of the earth on its axis of about 50ft and one wobble takes about 14 months to complete. In addition to this, the ice cap is so placed that its centre of gravity appears to be about 300 miles from the pole.

The total eccentricity brought about by the wobble and the great burden of the ice cap to one side could have serious consequences for us and the earth. It could cause disastrous centrifugal effects which would shatter the crust or cause the earth to tilt over.

This disaster is prevented by the earth bulging at the equator. This bulge acts like a stabilising flywheel. It has a gyroscopic effect. Everyone knows what happens to a fast revolving wheel which has become unbalanced. Unbalanced front wheels on motor cars cause serious wobble. Many a fast-revolving grinding wheel in workshops has shattered as a result of unbalance.

To summarise as far as we have gone, we have an earth consisting of a thin crust floating on a plastic mass. The crust is fractured in places. The earth is tilted on its axis with a heavy load of ice capping the southern pole. The earth wobbles on its axis, and the ice cap is out of centre. The bulging of the equator acts as a stabiliser for the centrifugal effects of the wobble and ice cap.

CLIMATIC CHANGES

We know that changes of climate have taken place throughout the ages and the finding of coral in the polar areas indicates a warm climate there at some time or other. Other evidence in other places shows beyond doubt that the poles were at some time warmer than they are now.

On the other hand evidence from glaciers which now exist in temperate regions shows that, at some time, great ice caps covered such places as Southern India and the centre of tropical Africa. It has also been established that these ice caps were not transported there but actually developed in those places.

To account for these climatic changes, various theories have been advanced.

One theory suggests that the poles themselves have shifted. This could be brought about by the earth's axis changing position with reference to the stars. This could mean that at some time or other, the South Pole was pointed directly at the sun. This would give us a cold pole and a hot pole with the hot pole never having darkness and the cold pole never having daylight. There is no evidence to support this idea.

Another way would be for the earth itself to shift on its axis, leaving the axis in the same relative position with reference to the stars. This would bring other positions on the earth's surface to the poles.

Compression of a region, resulting in a whole series of thrust faults, produces rugged, mountain terrain.

NO ADEQUATE FORCE

This theory has been discounted by the fact that no force can be found or imagined which would overcome the stabilising effect of the equatorial bulge which, as has been pointed out acts like a gyroscope requiring a fantastic force to throw it off course.

One theory which has held pride of place is that presented by Alfred von Wegener. This is the theory of continental drift.

Wegener's idea was that the continents, composed as they are of light, fragile rocks floating on a plastic substratum were once a single mass of land. Having fractured apart, the continents then began to drift away from each other over the plastic substratum.

Thus continents of the tropics drifted up to the poles and polar continents drifted into temperate climates.

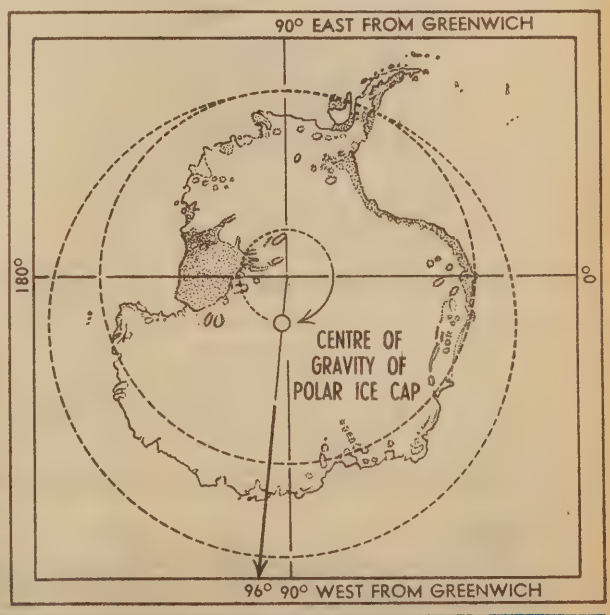
During their journeys, the continents collected bits and pieces from the various regions which could explain why fossils of warm climate fauna and flora found in polar regions and why evidences of ice caps are found in the tropics.

A geographical feature of the earth which seemed to support the theory of Wegener is the shape of the continents. If you glance at a globe map of the earth it would appear that South America can be fitted into the coast of Africa. You will find a lot of this apparent similarity. The whole globe seems like a jig-saw puzzle where the continents can be fitted together to make a continuous land mass.

Wegener's theory would thus explain the shifting of the polar regions. What would actually happen would be that the poles stayed in the same place but a different part of the earth would shift up to the poles.

PROVED WRONG

However, Wegener's theory required that the rock under the oceans was plastic and thin enough for the continents to drift over it. New methods of exploring the ocean floor have found that the floor of the oceans is extremely rigid. It is a layer of rock at least 20



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This diagram indicates the relationship of Antartica to the South Pole. The centre of gravity is about 345 miles from the Pole.

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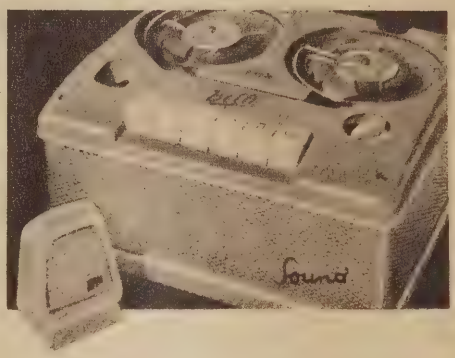

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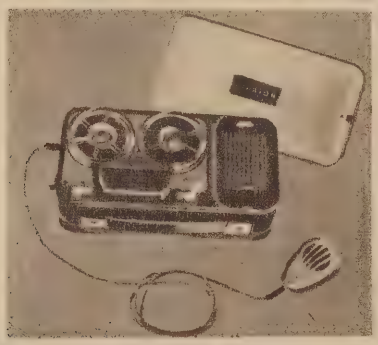

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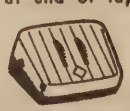

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miles thick making it impossible for continents to drift without moving this vast layer of solid rock.

Wegener also thought or assumed that the floors of the oceans were quite smooth, like plains.

If there were any high mountains there, they would be an obstacle to the drifting continent. Recent research with modern apparatus has shown that the floors of the oceans are by no means flat and smooth. There are mountain ranges as massive as any on land.

If the continents had drifted in accordance with Wegener's theory then there would be sediments on the ocean bottom which would provide a record of geological time since the oceans were formed.

New methods have found that the sediments of the oceans are very thin, in some parts only a few inches thick.

In the time of Wegener, it was thought that the last ice age in North America ended about 30,000 years ago.

Recent developments in the technique of radio-carbon dating have established that this ice age ended only about 10,000 years ago.

CLOSE NEIGHBOURS

According to Wegener, Europe and North America were very close neighbours, near the pole, during the last ice age. If they had drifted apart to their present positions since the last ice age which, as has been recently established was 10,000 years ago, then they drifted at the rate of 1,500ft a year—3,000 miles in 10,000 years.

The tremendous momentum gained by a continent set in motion would, as stated by Charles H. Hapgood in his book "Earth's Shifting Crust," mean that the drift would be still going on. Oceanic charts would have to be revised every few years and the distance between America and Europe would be forever increasing.

So it is we find that modern scientific techniques has once again tended to upset a popular theory and many scientists are now in disagreement with Wegener's theory.

There are always other fellows to come along with an explanation and there is no exception in this case. If Wegener's theory is not right, then what explanation have we of the climatic changes over the ages and such things as the making of mountains?

NEW THEORY

A new startling theory has now been put forward by Charles H. Hapgood of Harvard University, U.S.A. This theory was given a lot of attention by the late Albert Einstein and is gaining ground. Mathematical equations have been worked out by James H. Campbell to support Hapgood's theory but we will not touch upon these here.

The theory of Hapgood, without getting too technical about the matter, allows for a thin crust of the earth around a plastic interior, just as in former theories. However, Hapgood maintains that all the climatic phenomena just discussed, together with the formations of mountains, can be explained if this thin outer crust moves AS A WHOLE over the plastic interior.

To put it into the words of Einstein, "In a polar region there is a continual deposition of ice which is not symmetrically distributed about the pole. The earth's rotation acts on these unsymmetrically deposited masses, and produces centrifugal momentum that is transmitted to the rigid crust of the earth. The constantly increasing centrifugal momentum produced in this way will, when it has reached a certain point, produce a movement of the earth's crust over the rest of the earth's body. This will displace the polar regions toward the equator."

Now if you look again at the globe map of the world it is obvious that, if the whole of the earth's crust is moved bodily over its inner plastic core, leaving the axis in its original position, some of the areas of the earth will move closer to the equator and others will shift towards the poles.

SURFACE MOVES

As stated by Hapwood, "to be exact, two quarters of the surface, diametrically opposite each other on opposite sides of the earth must move equatorward, whilst the other two quarters move poleward."

In order to move the crust of the earth as a whole over its plastic interior, comparatively slight forces need be applied. Once the crust has been given momentum the force required to keep it moving would be slight indeed.

It must be remembered that it is the weight of ice placed out of centre around the South Pole, together with the eccentricity this has produced in the centrifugal force, that pulls the earth's crust over to one side.

This theory so far has everything which other theories have, without the requirements of the others, such as impossible forces to tilt the earth's axis, smooth plastic sea bottoms and so on. It can explain the ice caps which existed in tropical regions and the warm climate fossils in polar regions and so on.

It is in the theory of mountain building that this new idea is shown to advantage. I will attempt to make it clear enough without entering into technical matters as outlined by Hapgood in his book, "Earth's Shifting Crust." Interested readers are advised to refer to this book for some enlightening information.

The earth is not a true sphere. It is flattened at the poles and therefore appears to bulge at the equator, so that the diameter at the equator is about 26 miles greater than at the poles. The circumference of the earth at the equator is therefore about 78 miles greater than at the poles.

GREATER DIAMETER

It is obvious that if the crust of the earth is moved, all those parts of the crust north and south of the equator at opposite diameters will move toward the equator and will therefore have to be stretched over a greater diameter than they formerly occupied.

(Continued on Page 111)

DRILL SPEEDS UP QUARRY WORK

This new British drilling machine, here being demonstrated in a Derbyshire quarry, can drill four holes in rock face simultaneously and up to 32 feet from the working level. The two operators required can work for long periods without fatigue.

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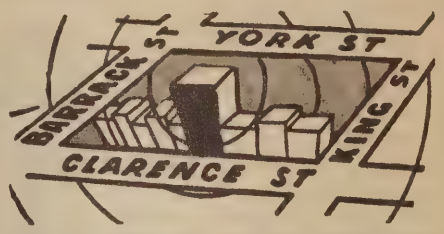

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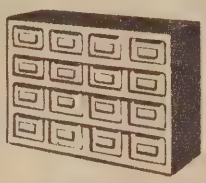

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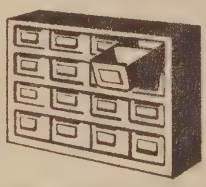

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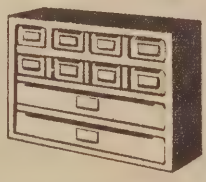

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Technical Review

THE LOG-PERIODIC - A NEW WIDE BAND ANTENNA

An aerial design currently in the news overseas is the logarithmic-periodic. Intended for amateur, combined UHF-VHF TV, and similar applications, it appears similar to the Yagi in gain and directivity, yet provides extremely wide band operation. This description is one of the most concise we have seen, and is reprinted from Electronics World (May 1960).

By Calvin R. Graft, W5LMF

THE logarithmically periodic antenna may be the answer to the antenna man's dream because it is broadband, omni-directional, and exhibits high gain. The log-periodic is so named because its electrical characteristics are repeated periodically as the logarithm of the frequency. Practically, it has a 10-to-one bandwidth; in theory, the bandwidth is almost infinite.

Gain is about 8 db above an isotropic radiator, roughly equal to that of a three-element yagi. Additional experimentation by the antenna industry will no doubt eventually result in gains of 10-13 db, about that of a five- to 10-element yagi.

WHAT IT WILL DO

What does this mean to the average amateur? It means that one antenna (shown in fig. 1), about the size of stacked three-element yagis for 10 meters, will be able to do the following: Cover all of the 10-meter band, the 40-mc Sputniks, the 50-mc. band, TV channels, 2-6, the FM band 88-108 m.c., the U.S. satellite frequencies at 108 mc., all of the two-meter band, TV channels 7-13, and the 220 mc band. The rest of the useful bandwidth of the antenna would take in part of the u.h.f. aircraft band of 225-400 mc.

To give an idea of the space saved, it would take 67 three-element yagis, each 4 mc. wide, to do the same job. And that is quite an antenna farm, even for the Texas boys!

This article will give a few of the parameters which describe the electrical operation of the log-periodic. Detailed design information can be found in the many articles which have appeared in various publications. Fig. 2 is a diagram of one of the sides which go to make up the antenna. Two such sides are spaced at a certain angle, such as a bow-tie antenna almost bent back on itself, and fed at the vertices of the triangles by means of coax line run up one of the booms (unbalanced) or by 150-ohm parallel-wire line at the apex (balanced). A stepped-exponential line within and bonded to the lower boom transforms from 50 ohms up to the 150-ohm feedpoint of the antenna. See fig. 3.

The log-periodic antenna, which has yet to be explained mathematically, appears to be an unusual animal. While there are many possible configurations of the basic unit of zig-zag elements placed on a boom, the most popular one at the present time is that shown in fig. 1. The unusual part comes from the fact that energy is fed directly to each boom (insulated from each other at the feedpoint), yet it is the cross zig-zag elements (all connected to the boom electrically and mechanically) which do the radiating (as in a yagi).

The phase point of the array moves toward the feedpoint as the frequency increases. As the frequency goes up, fewer of the larger elements are used and beamwidth and gain remain almost constant.

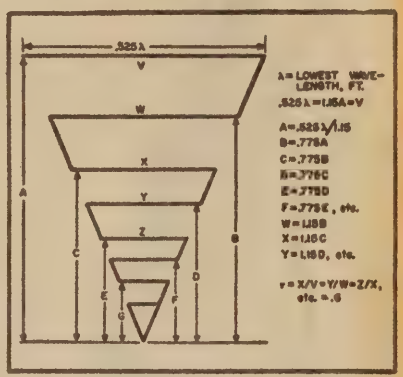

Fig. 2. Dimensions used in designing a log-periodic antenna. Refer to text.

Other configurations of the array include two planer log structures placed at right angles to each other to provide a horizontally polarised omni-directional pattern. Prior to the log antenna, there was no broadband horizontally polarised antenna, such as the discone for vertical polarisation. The elements can also be arranged to produce circular polarisation of either rotation sense.

A point is reached where the log-periodic does not provide sufficient gain in a system and it is more practical to go to a different type of structure, even

Fig. 1. A typical log-periodic antenna with a useful band width from 30 to 300 Mc.

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though the log might continue to work to a much higher frequency. In this case, a log can be used to feed a parabolic reflector. It used to be quite a task to change the narrow-band feeds of a large array such as a 28-foot dish when desiring a different frequency coverage.

However, Isbell reports using one log feed to cover 105 to 430 mc. Printed-circuit techniques can be used to form the feed when the frequency approaches several thousand megacycles.

Bandwidth of an antenna has to be related to v.s.w.r., gain, or polarisation. Most high-gain antennas have narrow useful bandwidths as determined by v.s.w.r. or gain uniformity. A yagi is performing well if it can crank out 5-7 per cent bandwidth. A practical log structure will keep running long after it has passed a 10 to 1 frequency ratio. The v.s.w.r of the log is generally less

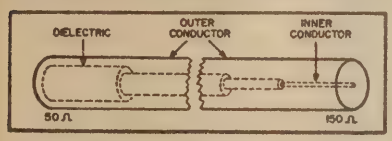

Fig. 3. Centre conductor of coax line stepped to provide impedance change from 50 to 150 ohms. Line runs up boom of lower antenna element. The more steps employed the smoother the transition.

than 2:1 across this band of frequencies. At this point, the mismatch loss is just .5 db.

High-frequency log antennas are available which cover 6.5 to 60 mc. in one structure. Think of the number of 3-element yagis required to cover this bandwidth.

Close modelling of the mechanical parts is essential for good electrical operation of the antenna. The longest element is about a half-wavelength for the lowest frequency and the shortest element is about 3/8 wavelength at the highest frequency. The element diameters must be properly tapered to assure smooth operation and become smaller as the frequency goes up. Operation at the high end is dependent on good modelling techniques of the apex of the triangle sides as this is the portion which does the radiating.

PARAMETERS

Fig. 4 shows the parameters which determine response of the log-periodic. Since there are so many variables. it is best to use a known set of values and reproduce the array without resorting to elaborate test methods which are generally not available to everyone. Directivity is in the direction in which the structure points—as that of an arrowhead.

Dimension for the individual sides are shown in fig. 2. The reducing process is continued toward the apex where the tubing becomes too small to work. At this point a solid piece of metal can be used, or a triangle made of the tubing.

The steps would be as follows: (1) determine the lowest frequency to be covered, (2) length of the longest element establishes low-frequency end of array, make this .525 lambda, (3) calculate the length of each element and its distance from the apex (starting with the longest) using the following relations: length of each element is 1.15 its distance from the apex; distance from the apex to each element is .775 the distance of the next

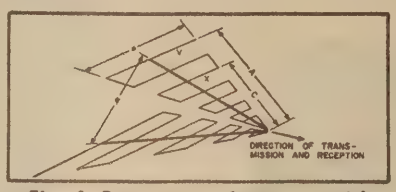

Fig. 4. Parameters of antenna with pi equals C/A equals X/V. 150 ohm feed point at apex of triangles. Note that one side of antenna is reversed.

longer element, (4) establish value of alpha (60 degrees is a good value), (5) establish value of tau, may be .4 to .707 (.6 is a good value), (6) establish large angle psi between the two antenna sections for highest gain (45 to 60 degrees is good).

With these parameters, gain would be 8 db over isotropic and front-to-back ratio would be better than approximately 10 db.

Additional experimentation by the industry may yield results which allow a single side to be fed and yet produce the same broadband results. In this case the array would be horizontal and look like a single yagi, occupying less space than the present design.

Much of the credit for the development and popularisation of the log-periodic should go to DuHamel of Collins Radio Company and Isbell of the University of Illinois who did much of the basic design and modelling of the array.

The log-periodic antenna will probably become increasingly popular in the future. There is no doubt that Minerva was guilty of understatement when he said: "Antennas of this nature represent a major advancement in the antenna field. It is felt that in a short period of time antennas of this kind will be located all over the world, and will be satisfying a great many requirements."

The author wishes to express his appreciation to Justin R. Duncan for his advice and comments during the preparation of this article.

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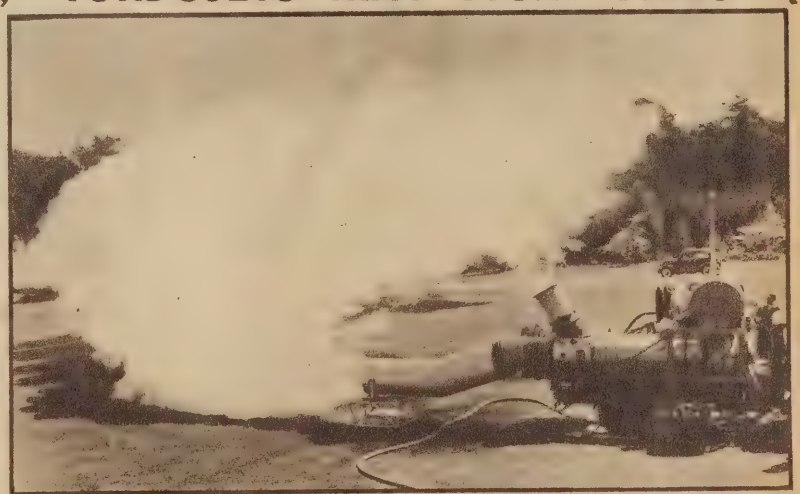
TURBOJETS MAY FIGHT FIRES



Picture shows a spectacular demonstration at the National Gas Turbine Establishment, Pyestock, Hampshire (England), of an inert gas generator powered by a turbo jet engine which may prove a powerful weapon in fighting big fires in the future.

Built at Pyestock on behalf of the Fire Research Station, Borehamwood— where the proposal originated— the purpose of the machine is to generate large quantities of inert gas (steam) which will suppress combustion. It is a self contained unit mounted on a five ton lorry and requiring only an external water supply for its operation. It is hoped that the method may be most useful for fires in basements and warehouses.

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REVIEW—HOT GAS GENERATES POWER DIRECTLY

A small moulded quartz generator, now in an aerosciences laboratory in Philadelphia, may be one solution to a major problem of extended space flight: How to create a power source that would supply a space vehicle with the current necessary for radio communication, electrical propulsion, light, heat and air conditioning; and keep within size, weight and efficiency specifications.

SUCCESSFULLY operated by General Electric's Missile and Space Vehicle Department, a working unit was developed less than a year after the company began studying the concept. The concept has been dubbed magnetohydrodynamics, or MHD.

Magnetohydrodynamic power generation extracts electric current from the motion of an ionized gas, heated to about 5,000 F. and passed through a magnetic field.

The process utilises the same classic electrical phenomenon found in steam turbo generation: voltage is created when a conductor is moved through a magnetic field.

IONISED GAS

In the steam turbo, Fig. 1A, the conductor is usually copper wire that is spun through a magnetic field by a turbine. In the MHD power generator, Fig. 1B, a very hot ionized gas such as superheated air, used as the conductor, is directed through the magnetic field where current is drawn off by electrodes.

Here no moving parts are involved. The energy contained in a high temperature air plasma, consisting of ionized atoms and electrons, is converted directly into electrical energy.

Lack of moving parts, high operating temperatures and compact parts mean that this type of generator has potential for great reliability.

The high temperature air plasma used as the conductor may be obtained from an arc or burner. In the G.E. development, a huge electrical arc, jumped between two points, heats the air to around 5,000 deg. F.

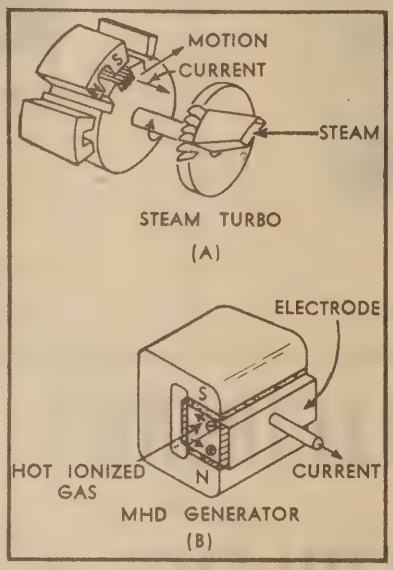


FIG. 1—In a conventional steam turbo (A) voltage is created when the copper wire spins through a magnetic field. The same effect is created in the MHD power generator (B) by directing a hot ionized gas through the magnetic field.

When this plasma passes through a magnetic field in the direction shown in Fig. 1B, the conducting gas cuts lines of force and generates voltage within the gas. The electric power is extracted from the flow of electrons.

Magnetohydrodynamic power can be used in a closed system, Fig. 2A, where thermal power sufficient to heat and move the conductor gas could be provided by solar energy or a fusion device. The closed system could be used on extended space flights.

In an open-cycle system, Fig. 2B, rocket exhausts could provide the current needed for short-time jobs on space vehicles that did not otherwise have sustained power requirements. Rocket motors now provide from one to three second operation, sufficient for example to provide power to transmit a TV image from a space vehicle that has been placed on the moon.

Leo Steg, manager of the G.E. Aerosciences Lab., has revealed several significant facts about the development The unit could feed an auxiliary power unit; could be used as an intermittent power source; or as a stationary power generator, the unit could be used as a topping device. That is, gas from the MHD source could be used as an input to a conventional stationary power plant.

The technique will require considerable development and time before it may be applied practically to stationary power generation. According to Steg, the major problems now fall into these areas: materials, air flow control, and how to bring the temperature down.

NEXT STEPS?

George Sutton, project engineer for M.H.D. at the Aerosciences Laboratory, and John McGinn and Willard Sutton, principal scientists concerned with the experiment, also stated that refinements of the power source, development of high temperature materials and consideration of weight factors are the next steps in MHD for space power.

In tests made with the MHD unit, approximately one kilowatt of electrical power was obtained for a period of five seconds. In principle, a MHD generator can operate continuously by controlling gas flow.

Two years ago, scientists at the G.E. Research Laboratory announced the development of a thermionic converter for direct conversion of heat energy into electrical energy. Last year, the company confirmed that they were working on chemical fuel cells that will be used for generation of electric energy.—(From "Electronics.")

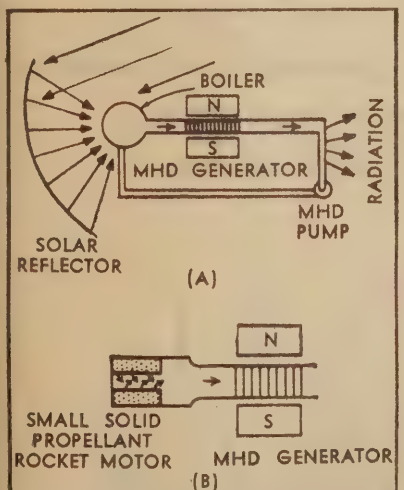
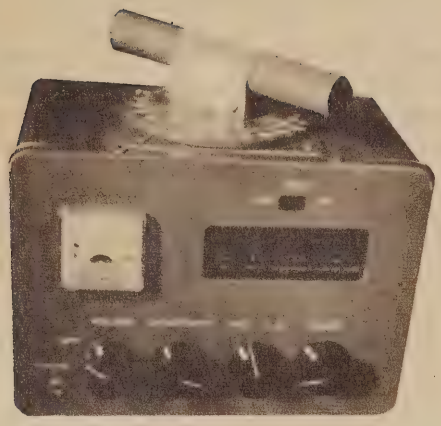


FIG. 2—A closed system for generating power might use a solar reflector (A) and gas could be recycled. An open system, (B), would use the intermittent power provided by the exhaust gases of a rocket motor.

AMATEUR COMES TO THE RESCUE

RADIO "hams" are constantly exchanging conversations with each other half across the world in a jargon all their own. Sometimes they pick up messages of vital importance. Such was the case when on March 2, a few days after the Agadir earthquake disaster, Bill Hayes, who works in the program operations department of the B.B.C. External Services and in his spare time is an enthusiastic "ham," was tuning his home-made amateur radio equipment over the 15-metre band and heard a Moroccan station calling for urgent help.

His transmitter was soon tuned in and contact was made with the Moroccan "ham" who had set up an emergency station outside Agadir, and was making an urgent appeal for the drug Mevophed in large quantities. Hayes immediately passed the message on to the local police, who in turn informed Scotland Yard. A few days later Hayes received a letter from the British Red Cross saying that Scotland Yard had passed on the message just as they were arranging for a team of doctors to go to Morocco and they had been able to send a supply of the drug with them.



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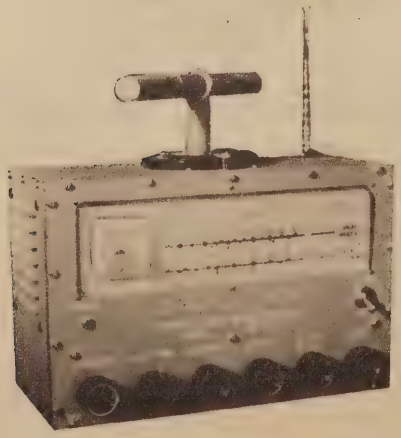

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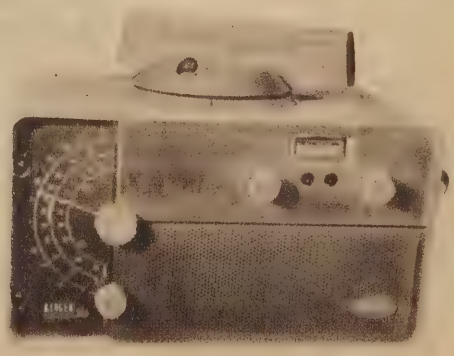

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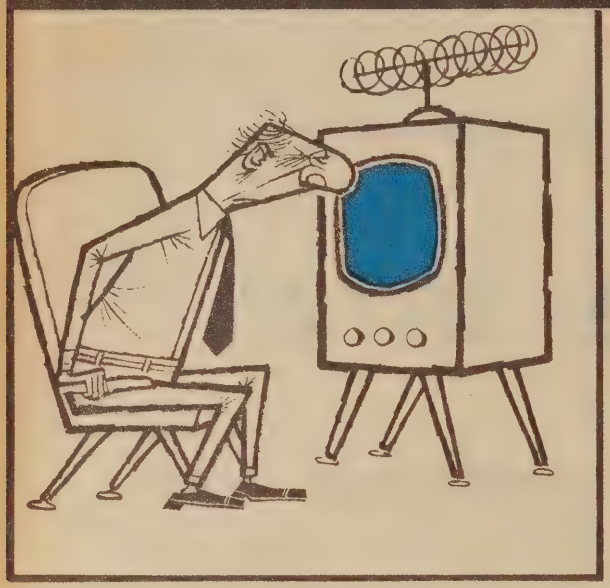

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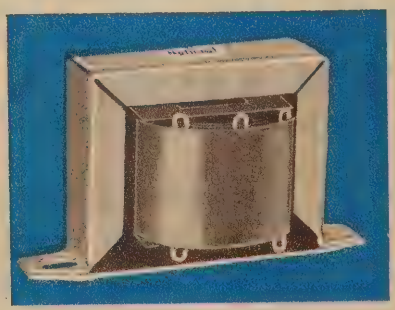

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SCIENTIFIC & INDUSTRIAL NEWS

LIGHTWEIGHT GAS TURBINES

OUTPUTS ranging from 50 to 20,000 shaft horse-power are available in a new range of gas turbines developed in the U.S.

Their uses include propulsion of high-speed hydro-foil boats, oilfield pumping, electricity generation.

The 20,000 b.h.p. model is being offered in a complete generating unit mounted on a 48ft semi-trailer. Its total weight is 95,000lb, including turbine, generator and switch-gear.

A smaller model, weighing 300lb in its basic form, can run on a variety of fuels, including marine diesel oil and aircraft fuel.

International General Electric, Schenectady, New York, U.S.A.

HIGH-PRESSURE PRESS

A HYDRAULIC press of revolutionary design, which can apply pressures of the order of two million lb per square inch, or more, equally to every side of a cylinder 3in long and ¼in in diameter, has been developed.

These pressures are great enough to convert graphite into diamond. Previously, presses capable of generating such very high pressures could not handle samples of raw material much larger than a small bead of say, 1/8in to 1/6in in diameter, although in one case larger samples of the order of ¼in in diameter are said to have been processed.

The operation of the press exerts a force of 2,500 tons on each of four anvils.

The new press is expected to be used for the production of sizable experimental quantities of novel stronger heat-resistant metals as well as for investigations into new ceramics, or materials having diamond-like properties.

Research is also being carried out into the design of larger presses capable of processing consistently larger quantities of raw materials.

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A NOVEL cement which can be used to bond together large and complex carbon and graphite structures for operation at continuous temperatures of as high as 3,600 degrees Fahrenheit (1,982 degrees Centigrade) without failure, or weakening, has been developed.

Tests have shown that even under the most prolonged and exacting operating conditions the cement bond will remain as strong and chemically resistant as the carbon, or graphite, of the structure.

The compound is prepared for use easily by mixing the powder and liquid ingredients and is said to have an exceptionally long pot life.

The cement is cured for only a brief period at low temperature and is therefore said to be easy to use.

Union Carbide International Company, 30 East 42nd Street, New York 17, U.S.A.

SELF-POWERED WHEEL

THE latest development of an old idea for powering road vehicles is a "motorised wheel" which has been designed in the U.S. It is intended for use on vehicles operating in rough terrain and heavy construction work.

An electric traction motor is included as an integral part of the wheel, eliminating transmissions, axles and gearboxes. Electric power is obtained from a generator driven by the vehicle's engine.

The wheel has a 10ft high tubeless tyre with the electric motor and gearing in the wheel hub. It is stated that a vehicle fitted with four of these wheels would be capable of developing 1,520 b.h.p.

International General Electric Company, Eric, Pennsylvania, U.S.A.

ROLLS OF CORRUGATED SHEETING

TRANSLUCENT corrugated fibre-glass sheeting, produced on the Continent by a continuous process patented by Montecatini, of Milan, Italy, is manufactured by a process which makes it possible to produce sections of almost unlimited length and six feet wide (in a direction parallel to the corrugations). The material is also sufficiently flexible to be stored or transported in roll form.

An advantage of the sheeting's being available in long lengths is that it can be used for temporary buildings, rolled up and then used again at a later date. The surface requires no maintenance and the material is shatter-proof.

A range of light-fast and weather-proof, translucent and opaque, colours is available.

PREVENTING ROT

THE formation of bacterial and fungicidal rot on wood, leather, cotton fabrics, hemp and other similar materials can be prevented by the application of a series of new compounds which contain metal salts.

The N-alkyltrimethylene-type metal compounds are especially efficient in preventing bacteriological and fungicidal attack under an exceptionally wide variety of conditions.

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Armour Hess Chemicals, 4 Chiswell Street, Finsbury Square, E.C.1, England.

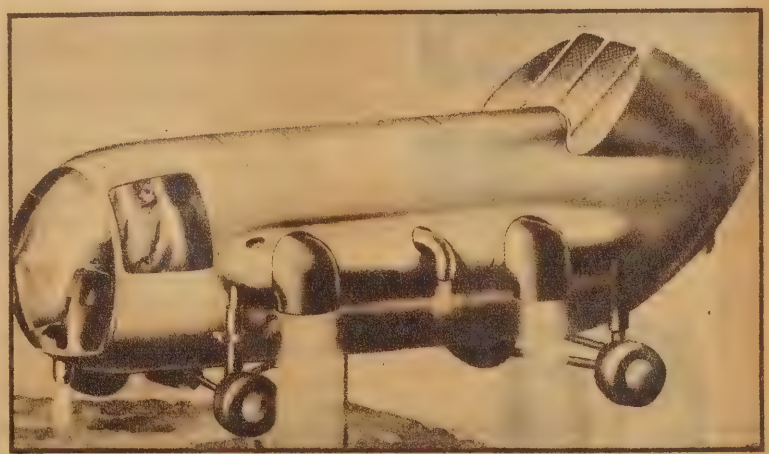
RETARDING CORROSION WITH ATOM URANIUM

UNDERWATER pipelines, ships' hulls and similar structures exposed continuously to corrosive conditions may be protected by means of the development of new techniques for using uranium which has been "burnt" in nuclear reactor furnaces and so depleted of much of the fissile uranium 235 it previously contained.

Experiments which have been carried out with the use of the metal—which is becoming increasingly abundant as a by-product from the operation of nuclear reactors—as a "sacrificial" anode, have indicated that it may well prove more effective than conventional zinc and magnesium in retarding galvanic corrosion.

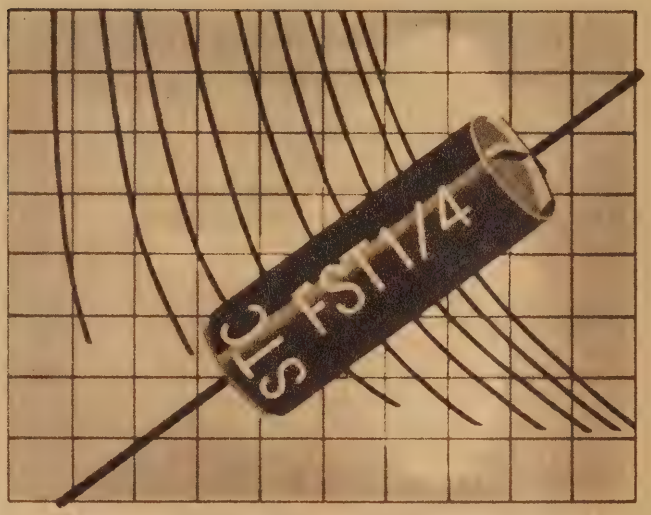
Rolla Metallurgy Research Centre, Missouri, U.S.A.

"FLYING PIG" FOR THE SERVICES?



Bristol-Siddeley Engines Ltd. have submitted plans to the three Services for a revolutionary new vertical takeoff car-plane. Called the "Flying Pig," and powered by lightweight jet engines, the Pig could drive like a lorry along the road, then take-off and fly at 230 m.p.h, lifting 1½ tons to 5,000 feet. The military operating ceiling could be as high as 15,000 feet.

NOW in full supply!



Silicon H.T. Power Rectifier

TYPE FST 1/4

for TV receiver power supplies

FST1/4
FST1/4
FST1/4
FST1/4

Specially designed for domestic television receiver H.T. power supplies, the FST 1/4 has high operating efficiency. It may be wired directly into circuit and is suitable for use with printed circuitry, no heat sink being required. The encapsulated case is totally inert. Immediate delivery of production quantities is available.

CHARACTERISTICS :

1. Peak Inverse Voltage ..... 400 volts*
2. Maximum Forward Volt Drop at 500 mA (50° C.) ..... 1.1 volts

*This value is the absolute maximum. Due attention must be paid to the effects of supply voltage variation, transformer regulation, etc.

RATINGS :

Maximum Load Current (mean D.C.)	500 mA
Maximum Operating Ambient Temperature for 500 mA Full Ratings	50° C.
Load Current Derating Factor (above 50° C.)	10 mA per °C.
Maximum Dissipation	550 mW
Maximum Surge Current	35 A for 5 ms
Minimum Series Resistance (two diodes in series)	10Ω (for 250 V r.m.s.)
Maximum Capacitive Load	400 μF
Maximum Peak Repetitive Current	5.25 A

Standard Telephones and Cables Pty. Ltd.

SYDNEY • MELBOURNE • BRISBANE

AN ITT ASSOCIATE

C104

HEAT RESISTANT PLASTIC

A NEW polyurethane-based plastic coating which has been developed is capable of withstanding temperatures of the order of 6,000 degrees Fahrenheit, and contains a series of boron and phosphate compounds which are bound together by the plastic.

The compound is applied in the form of a thickish liquid by means of a spray or brush.

It forms a hard ceramic crust on setting which reflects heat. At the same time, when the coating is exposed to flame it foams and swells, and so provides a series of protective layers which are removed one after another as this process continues.

Dyna-Therm Chemical Corporation, 3813, Hoke Avenue, Culver City, California, U.S.A.

PLASTIC GLAZING

A NEW grade of weatherable polyester film is available in 500 gauge (about 0.005in) thickness and coated on one or both sides with an ultra-violet light retardant. A life expectancy of some four to seven years is claimed for the material.

Another advantage of the film is said to be its great tensile strength. This is over 20,000lb per square inch.

GAS, LIQUID FILTERS

A SERIES of new membrane-type filters, which are made of thin plastic sheets having very small holes of uniform size and which are said to have novel performance characteristics, has been developed.

The new plastic filters can be made with holes which range in diameter from 0.2 thousandths of a millimetre. The material is built up in such a fashion that the holes, or cavities, in it occupy at least 80 per cent of the volume of the filter.

The filters are exceptionally efficient at extracting minute "sub micron" particles (particles having a diameter of less than one thousandth of a millimetre) from fluids and gases.

They are exceptionally efficient in filtering microscopic material from gases because the particles are extracted from the gas stream not merely by the physical barrier present by the hole size, but also by the electrostatic charge which is set up inside the holes by the friction generated by the passage of the gas and particles.

The occurrence of this latter phenomenon causes particles much smaller in size than the actual diameter of the holes to be held back by the filter. The filters are made from cellulose esters by means of a technique which is similar to that used to produce plastic films.

Gelman Instrument Company, Chelsea, Mitchigan, U.S.A.

CHEAP SURFACING

A NEW type of road surfacing material is reported as being successfully tested in Norway during the recent winter months. It consists of gravel mixed with "road oil" which resembles heavy fuel oil in appearance.

This surfacing is said to be particularly suitable for areas where little money is available for road construction. Flexibility is also maintained at very low temperatures enabling it to resist frost damage.

STRONGER FIREPROOF WOOD

A PROCESS for making wood stronger, water resistant and fireproof, can be applied to both hardwoods and softwoods. Tests are said to have shown that treated pinewood, for example, has more than three times the resistance to compression of untreated wood, while the resistance of the wood to static bending is increased by about 30 per cent.

At the same time the water absorption of the wood is reduced to less than one-fifth of that of untreated wood when the wood is exposed to water for periods of 10 days, or more.

The operation of the process depends on the impregnation of the wood with a styrene resin and its subsequent exposure to radioactive radiation.

Karpov Institute of Physical Chemistry, Moscow, Russia.

NEW FLOW-METER

THE expensive internally tapered glass calibration tube has been eliminated in a new design of flow-meter developed in Britain by the Atomic Energy Authority.

A straight-bore tube is used to carry the liquid, and an externally tapered rod is located in the tube. An annular float can move on this rod to indicate flow.

The rod can be made of metal and can easily and cheaply be machined to the necessary taper. For viscous liquids, heat can be provided by electric heating of the rod.

Accuracy is within plus or minus 0.5 per cent over a range up to 20.1, plus or minus 0.1 per cent. Calibration is said to remain constant over a wide variety of liquids and for various rates of flow.

U.K. Atomic Energy Authority, Patents Exploitation Officer, 11 Charles II Street, London, S.W.1, England.

SHRINKABLE POLYTHLENE

A NEW type of polyethylene film can be stretched by more than 200 per cent in two directions, and also automatically starts to shrink equally in all directions back to its original size when it is heated to 180 degrees Fahrenheit or over.

The new film is of the low-density, high-pressure polyethylene type, and is said to have tensile strength ranging between 8,000 and 16,000lb per square inch after it has been processed, varying according to the film's thickness. This compares with strengths of 1,350 to 2,500 p.s.i. before processing.

The film is expected to find a number of novel uses in industry such as form-fitting wrapping for foods and packaging for mechanical parts, where tight fitting is exceptionally important.

The film, which is a "breathing" type and has good printing qualities, high clarity and gloss, has the disadvantage that it tears easily once a tear has been started.

It is manufactured by a special cross-linking technique, which involves the use of irradiation with an electron beam generator, capable of producing beams of an intensity of up to two million electron volts.

W. R. Grace and Company, Cryovac Division, Greenville, South Carolina, U.S.A.

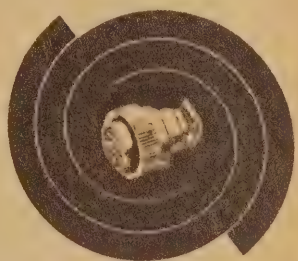
CANNON PLUGS

Rack/Panel/Chassis & Miniature

Standard DPD -- strong aluminium shell for unit-plug-in applications. Wide range of contact voltage and amperages, including coaxials.

Miniature rack & panel type: shell protected 13 available insert arrangements: 5-amp, 10-amp and miniature coaxials: split shell.

D Sub-miniature rack/panel type: steel shell protected: all 5-amps, 9 to 50 contacts; flash. 1700v dc: junction shells, locking means, floating mounting holes: also hermetic seals.

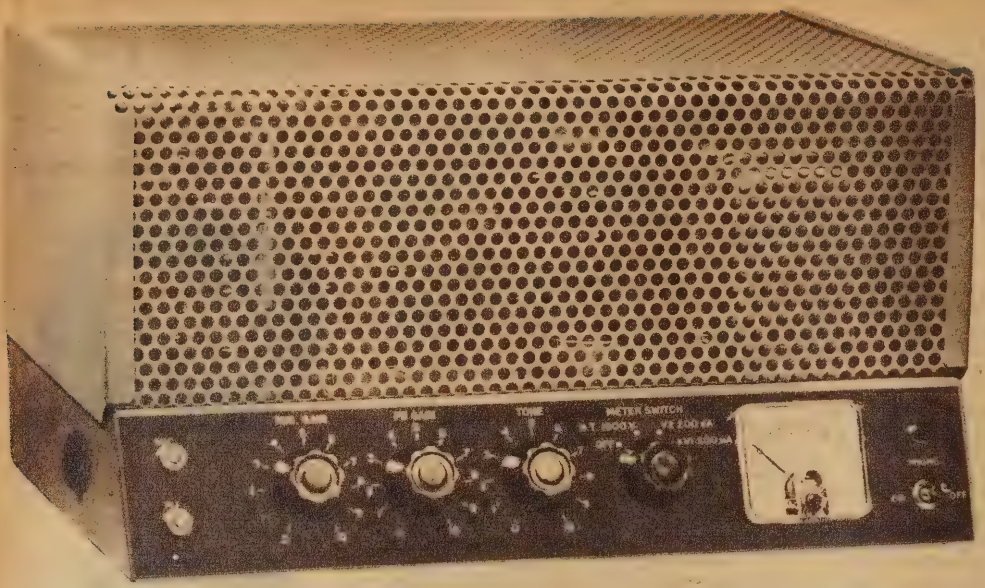


K-Miniature: circular, aluminium shell protected: 3, 10, 20, 30, 38 contact arrangements; voltage up to 4000v ac. Also hermetic seals.

For information, write to Dept. RTH3, CANNON PLUGS (AUST.) PTY. LTD., Cnr. Matthews Ave. & Hood St., Airport West, W.6, Melb., Victoria.

SINCE 1915

CANNON ELECTRIC



The finished amplifier, complete with cover and engraved front panel. Its facilities and power output make it suitable for almost any P.A. requirement.

A 100 Watt Public Address Amplifier

Here is the most powerful public address amplifier ever to be described in these columns, capable of delivering 100 audio watts. It is ideal for handling the really big jobs in large halls, fair grounds and such like. Its general design is right up to the minute.

By Neville Williams and Brian Cleaves

THOUGH we have had requests in the past for some such design the difficulties of producing it and making it a marketable proposition have outweighed the limited demand. Our higher-powered designs in the public address field have, therefore, been limited to around the 40 watts, which was easily attainable with 807 type valves.

SPECIAL JOB

Just recently, however, the opportunity to tackle something larger occurred when a division of our parent company wanted a big amplifier for pageing in a new large building. An examination of the proposition showed the possibility of building the amplifier required for the particular job as well as deriving from it an interesting article.

But why 100 watts? Is it because it's 10 times louder than 10 watts? Is it the largest anyone is ever likely to want? Is it the largest practical design?

The answer is no, no, and again no! Under practical listening conditions a 10 times increase in power does not produce a sensation of sound level being increased by that amount, because of the "AVC action" of the ears, as indicated by operation of the decibel scale.

However, what is often more to the point, a 100-watt amplifier will operate 10 times as many speakers at a given sound level as a 10-watt amplifier.

Again, while almost any audio power can be obtained, given components of adequate capacity, 100 watts represents a very substantial "round figure" which can now be achieved using components and techniques which are within the orbit of servicemen and advanced hobbyists.

What a 100-watt amplifier will achieve in terms of coverage depends a great deal on the speakers used to disseminate the sound. Different types vary enormously in acoustic efficiency and directivity, as well as in frequency response, distortion and unit cost.

The choice of speakers is a question which is really best resolved with those who supply them but, in any case, cannot be further pursued here.

Coming back to the amplifier, its power is delivered, in the ultimate, from a pair of the relatively new KT88 valves. These are used in this circuit, in class B1 ultra-linear conditions, the actual circuit being closely akin to one featured recently in the valve manufacturers' journal "Radiotronics."

Several points about this method of operation are worthy of explanation. Firstly, there is the matter of "class B1."

The traditional class B method of operation is, of course, well known. It involves applying a fixed bias to the output valves so that they operate from very close to cut-off. Each works into a relatively low value of load, as presented by the output transformer ratio half primary to full secondary.

Each is driven by the input signal well into the grid positive region, in order to secure high conduction through the valve and low voltage drop across it. Since the input grids are driven positive and draw current, the operating condition should rightly be referred to as class B2; the drive has to be supplied from a low-impedance push-pull source, normally involving a "power" driver stage and a special driver transformer of critical design.

NO GRID CURRENT

With valves like the KT88, it is possible to achieve the necessary conduction and low voltage drop without resorting to positive grid operation. Therefore, by operating the valves at near cut-off and carrying the grids to zero on signal peaks, a very large excursion of plate current is initiated through the load, which adds up to substantial power output.

And since the grids do not swing positive, the mode of operation is defined as class B1, and the need for a special low impedance signal source is eliminated.

Then there is the matter of ultra-linear (or divided load) operation.

It is debatable whether adequate conduction could be obtained through valves of simple triode structure, since the "incentive" to large electron flow disappears as the plate voltage falls during plate current peaks.

The field provided by the screen of a tetrode or pentode is necessary to sustain current flow with low plate voltage. Therefore, class B1 operation relates more naturally to tetrode or pentode rather than to triode operation.

DISTORTION PROBLEM

But this gives rise to the further difficulty that uncompensated pentodes or tetrodes, operating into reactive loads (viz. loudspeakers) are likely to produce excessive peak voltages on high-frequency signal components, as well as generating more than their share of distortion.

Negative feedback is not the complete answer to this problem since it is not very effective during those portions of the input cycle where the two output valves are each close to cut-off.

Neither is it completely satisfactory to connect an R/C filter across the load. The diversion of power into the filter can mean loss of treble response from the speakers, as well as presenting dissipative problems.

From published figures, and from our own results, it would appear that the ultra-linear arrangement provides a neat solution to the problem. While the screen "swings" with signal sufficiently to simulate triode behaviour, it does not digress sufficiently from the HT line to prevent it (in the DC sense) from sustaining high conduction at the minimum plate voltage swing.

As a result, the requisite high power is obtained at a modest distortion level and in keeping with the results normally expected of a public address system.

For the conditions under consideration, the KT88 valves require a power supply of 560 volts at current figures ranging to 325 mA., depending on the output signal level. As with all class-B amplifier systems, the real problem is to obtain adequate voltage regulation.

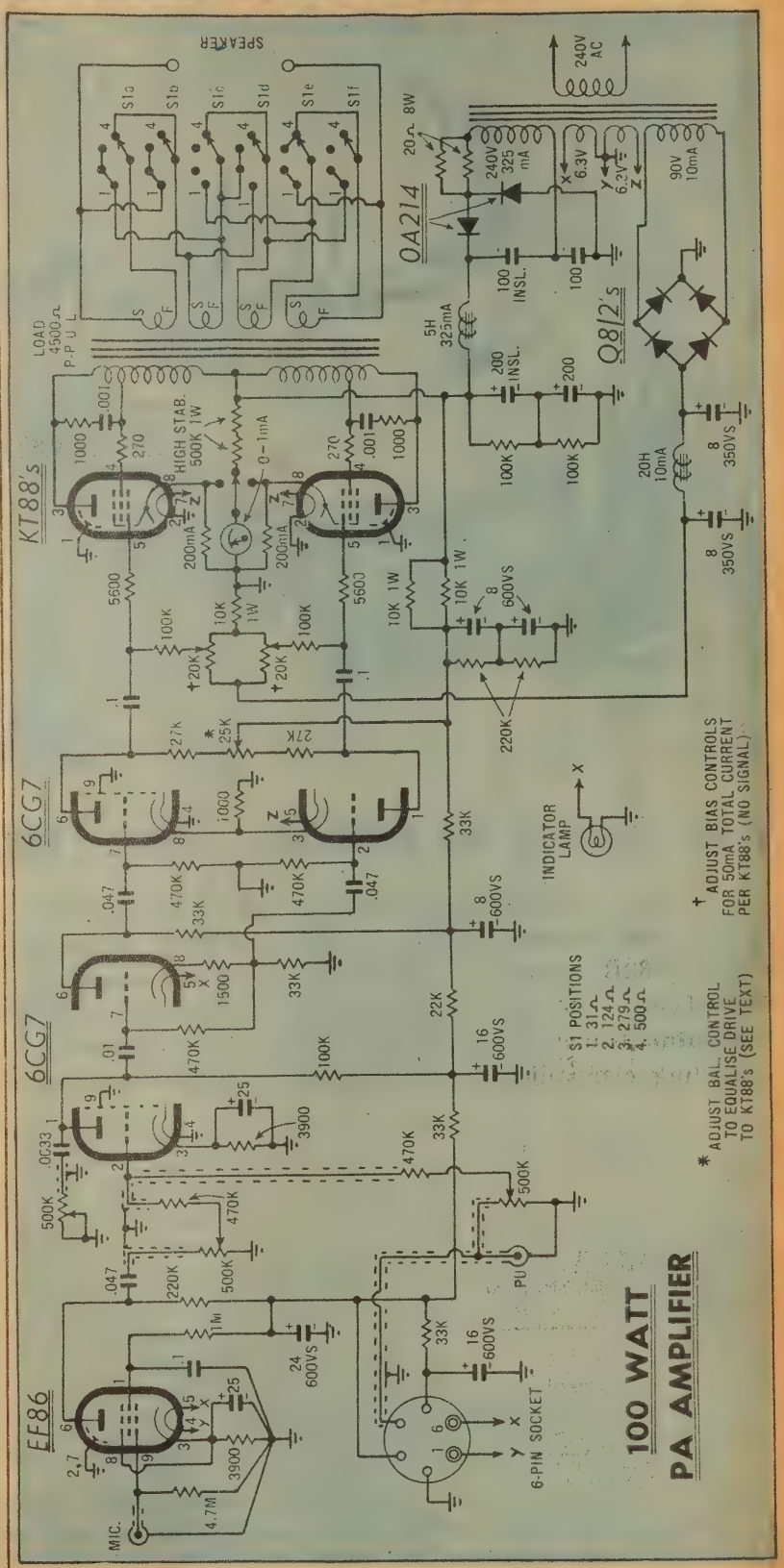
Much to our surprise, investigation showed that the voltage-doubling silicon rectifier type of supply, currently being used for television receivers, had better potential regulation than the traditional choke input filter, full-wave rectifier.

SPECIAL COMPONENTS

Before we could specify it, however, we had to be sure of the supply of silicon diodes with a specially high peak inverse rating. The ordinary 400-volt types will not do.

Then, also, we had to await the development of high voltage, high capacitance electrolytics for the doubler input position. These need to be special types, designed to operate with high ripple current. Again, ordinary types should not be used, even though their voltage ratings may appear to be adequate. One needs to have an insulating and protective type of mounting.

The H.T. filter is completed by a choke and two series-connected electrolytics, with 100K resistors across each to equalise the applied voltages. One of these needs also to be insulated and protected from accidental contact.



The circuit provides microphone and pickup inputs, with mixing facilities. In addition, it may be used with a separate mixer unit giving additional inputs and facilities. Note the special switching arrangement used to select the required output impedance.

Final check of the NEUMANN "Teldec" Stereo cutterhead . . .

NEUMANN disc recording machines and stereo cutterheads go through final inspection at the Georg Neumann G.m.b.H. works in West Berlin, Germany. These machines, lathe type AM32B (complete with fully automatic groove pitch and depth control), and the new "Teldec" stereo cutterheads as well as the famous NEUMANN condenser microphones, both miniature and standard sizes, being of the highest standard, are used by ALL leading recording companies in America, the United Kingdom, in Europe, Australia and Japan.

The range of sound recording and reproduction equipment distributed by Simon Gray Pty. Ltd. now covers EVERY item in the audio chain, from microphones to tape and disc recording machines, on to pickups, amplifiers, turntables and loudspeakers. Besides, there is a range of many specialised items of professional studio equipment.

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There are microphones for every purpose — NEUMANN, GRAMPIAN, SIMON. There is the remarkable TANDBERG tape recorder and the NEUMANN disc recording lathe (see above); recording stylii from HARCOURT and disc recording blanks from U.S.A.

When it comes to reproducing sound, engineers and enthusiasts alike choose LEAK amplifiers, ORTOFON pickups, C.E. and ORPHEUS turntables and the full range of WHARFEDALE loudspeaker systems.

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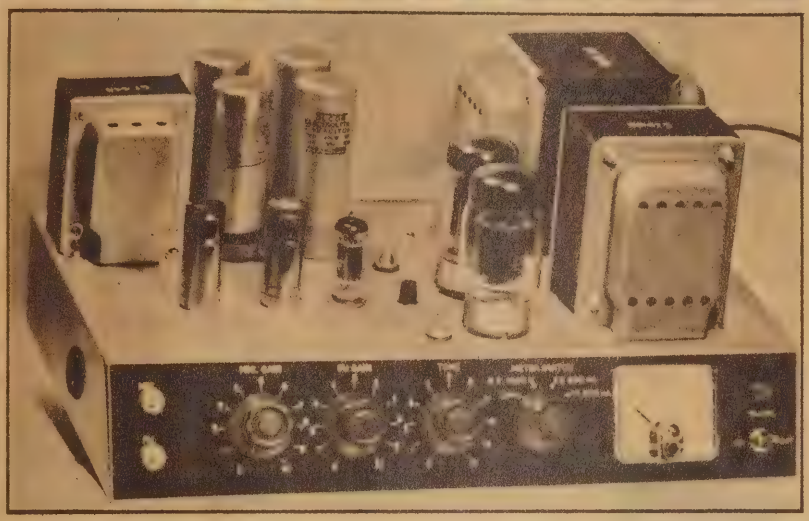
LAYOUT OF MAJOR COMPONENTS



The two shielded valves on the left are the EF86 and 1st 6CG7 in that order, followed by the 2nd 6CG7 and the two KT88s. At left rear is the main filter choke, right rear the power transformer, and right front the output transformer. Note the meter used to monitor operating conditions.

A 10 ohm series resistor in the rectifier circuit is intended to minimise peak currents through the rectifiers, and the input filter capacitors. The series resistor is made up from two 20-ohm 8-watt resistors, connected in parallel.

A supplementary circuit in the power supply provides a fixed bias for the two grids. The supply is nominally rated at 90v. 5mA, but the actual bias used is subject to adjustment.

As indicated by the circuit, grid and screen "stoppers" are included to ensure stability, as well as a network between the plate and screen tappings on the output transformer.

Provision has also been included for setting up and metering the conditions for the output stage. Thus, separate 200 mA. shunts are provided in each cathode circuit, across which the meter can be switched as desired. By means of the bias adjustments, the cathode currents of each valve should be maintained at 50 mA. with no signal input.

VOLTAGE RANGE

A further position of the switch connects the meter in series with a 1-meg. resistor across the HT supply, so that it reads the HT voltage on a 1,000-volt scale. The resistor should be a 1-watt high-stability type, with a voltage co-efficient rating comfortably in excess of the 560 volts which it will need to withstand.

If there is any doubt on this point, it would be preferable to use two series-connected 0.5 meg. high stability resistors.

In any case, close tolerance resistors should be used to ensure an accurate reading of voltage.

Although the metering allows the no-signal plate currents of the output valves to be balanced, it does not ensure balance on output peaks, which is a function of drive and of valve transconductance.

In this case, optimum balance can be achieved by varying the setting of a 25K pot. in the plate circuit of one driver valve.

Balance can be checked by comparing the output on a CRO developed across each of the cathode shunts. A better method is to set up the amplifier with an optimum resistive load, turn up the input to the point where clipping just begins and adjust the drive pot. for equal clipping on both peaks.

Both methods assume, of course, that the input waveform is itself pure.

It is a good idea to insulate the balance potentiometer from chassis to obviate any risk of a HT short. Similar precautions should be taken with the bias pot., not in this case because of the voltage, but because failure of the bias supply to the output valves would be quite tragic.

Special consideration had to be given to the matter of the output transformer secondary, with a view to obtaining a reasonable range of impedances without sacrificing efficiency.

FOUR WINDINGS

The arrangement finally adopted was to provide four separate secondary windings, each for a nominal impedance of 31 ohms. The requirement is that all windings be used simultaneously, in order to avoid "idle" copper and window space.

Thus the four windings may be connected in parallel to provide for a 31-ohm load. The four in series match to a 500-ohm load.

The four in series-parallel match to 124 ohms, while two in parallel, connecting in series with the other two, provide for 279 ohms.

Naturally, in effecting these connections, correct phasing is vital, for which reason the coding relating to the start

(Continued on Page 35)

PARTS LIST

- 1 Chassis to suit, see text.
- 1 Power transformer 240v. 325 mA. 6.3V 4A. 6.3V 4A. 90V. 10mA. PF1546 or similar.
- 1 Output transformer Prim. U L 4.5K plate-plate Sec. 500 ohms tapped. Op413 or similar.
- 1 Filter choke 5H 325 mA. CF448 or similar.
- 1 Filter choke 20H 10mA. CF447 or similar.
- 1 Switch 6 pole 4 pos. 250V 10A. (See text).
- 1 Switch 2 pole 4 pos.
- 1 Meter 1mA. (small).
- 2 Silicon diodes OA214.
- 4 Selenium rectifiers type Q8/2 or similar.

VALVES

- 2 KT88
- 2 6CG7
- 1 EF86

SOCKETS

- 2 Octal mica filled
- 2 Miniature 9 pin with shield, one to be tinplate, Philips type B8700/55. (See text).
- 1 Miniature 9 pin plain.
- 1 3 pin recessed plug and socket
- 1 6 pin
- 2 Single contact mic. plugs and sockets C/1/02m or similar.

CAPACITORS

- 1 100mfd 350VW electrolytic voltage doub. EMG1584
- 1 100mfd 350VW electrolytic insul. voltage doub. EMG1585S
- 1 200mfd 350VW electrolytic EMG2035.
- 1 200mfd. 350VW electrolytic EMG2035 (Insulated type)
- 3 8mfd. 600VS electrolytics.
- 2 8mfd. 350VW electrolytcs.
- 2 16mfd. 600VS electrolytics.
- 1 24mfd. 600VS electrolytic.
- 2 25mfd. 40VP electrolytics
- 3 .1mfd. 600V paper.
- 2 .047mfd 600V paper.
- 1 .047mfd. 400V paper
- 1 .0033mfd. 600V paper
- 1 .01mfd. 600V paper
- 2 .001mfd. mica.

RESISTORS

- 2 270 ohm ½W
- 2 1K ½W
- 1 1K 1W
- 1 1.5K ½W
- 3 10K 1W
- 2 27K ½W
- 1 22K 1W
- 2 5.6K ½W
- 2 3.9K 1W
- 2 100K 1W
- 3 100K ½W
- 1 220K ½W
- 2 220K 1W
- 1 1meg. ½W
- 2 500K 1W hi-stab.
- 5 33K 1W
- 1 4.7meg ½W
- 2 20 ohm 8W
- 5 470K ½W
- 2 20K potentiometers
- 3 500K potentiometers
- 2 200mA. meter shunts.
- 1 25K potentiometer

SUNDRIES

- 1 Mains on-off switch
- 1 Pilot lamp assy.
- 7 2 tag terminal strips
- 2 4 tag terminal strips
- 1 7 tag terminal strips
- 2 5 tag terminal strips
- 1 6 tag terminal strips
- 2 stand off ceramic insulators.
- 1 Yd. PT9M Coaxial cable
- 4 Clamps for electrolytic capacitors.

Hookup wire, power flex, grommets, nuts and bolts, solder lugs, etc.

A *Super* RADIOTRON

Within the *Super* RADIOTRON range of valves will be found types for use in all electronics applications.

Aviation... 5786

The 5786, used in the ground beacon transmitter of DME,* will deliver a power of one kilowatt at 160 megacycles.

* Distance Measuring Equipment.

High Fidelity... 7199

A medium-mu triode with sharp-cutoff pentode specifically designed for hi-fi applications where low microphony and low hum/noise figures are essential.

AMALGAMATED WIRELESS VALVE CO

Valve for every purpose...

There can be little doubt of the vital part played by electronic valves in the highly specialised fields of technology which play so great a role in our modern way of life.

It is indeed hard to imagine the extent to which electronics have aided scientific progress in the past half century, and many of the devices that serve to make life easier depend upon electronic valves for their continued performance.

Little wonder that there are now no less than 130 types in the Super Radiotron valve range used in fields as diverse as Education, Aviation and Medicine.

These are just a few of the great number of applications to which Super Radiotron valves may be put. Whatever your particular valve requirements, the Super Radiotron range of electronic valves has a type to suit your electronic application.

Medical... 810

Used in diathermy equipment and electric scalpels. This type has long been in use in a wide variety of transmitting equipment.

Education... AV43

Newly-developed demonstration cathode ray tube of ingenious design. For visual instruction on the behaviour of an electron beam in electrostatic and magnetic fields.

AWV

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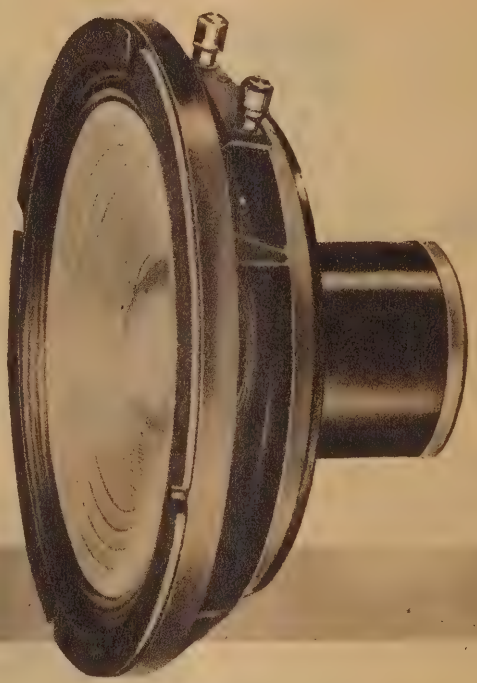
when space is limited for STEREO.. here is the answer ...

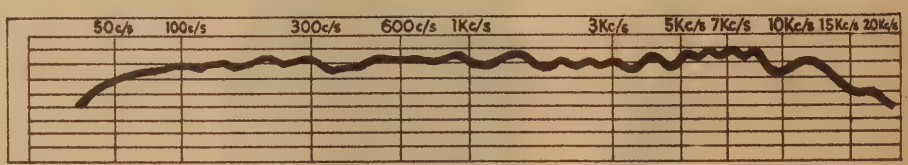
For stereophonic sound the Axiette II single-cone High Fidelity Loudspeaker offers small size (only 8⅛" diameter) without sacrifice of High Fidelity standards of sound reproduction. It provides extensive, yet extremely well-balanced frequency coverage achieved by scientific design of the radiating system. When suitably enclosed and operated at normal listening levels, even the most critical listener will be impressed by the "big" performance of this outstanding 8" High Fidelity Loudspeaker. Another important feature is the rugged, die-cast frame imparting extreme rigidity.



Axiette II

HIGH FIDELITY LOUDSPEAKERS

Typical Response Curve for Axiette II



SPECIFICATIONS:

Flux Density: 15,000 gauss. Frequency Range: 40-15,000 c/s. Fundamental Resonance: 65 c/s (nominal). Maximum Power Handling: 7½ watts (15 watts, U.S.A. rating). Impedance: 15 ohms. *PRICE: £16.*

GOODMANS

Plans and specifications for special Reflex Enclosures for Axiette II are available from British Merchandising.

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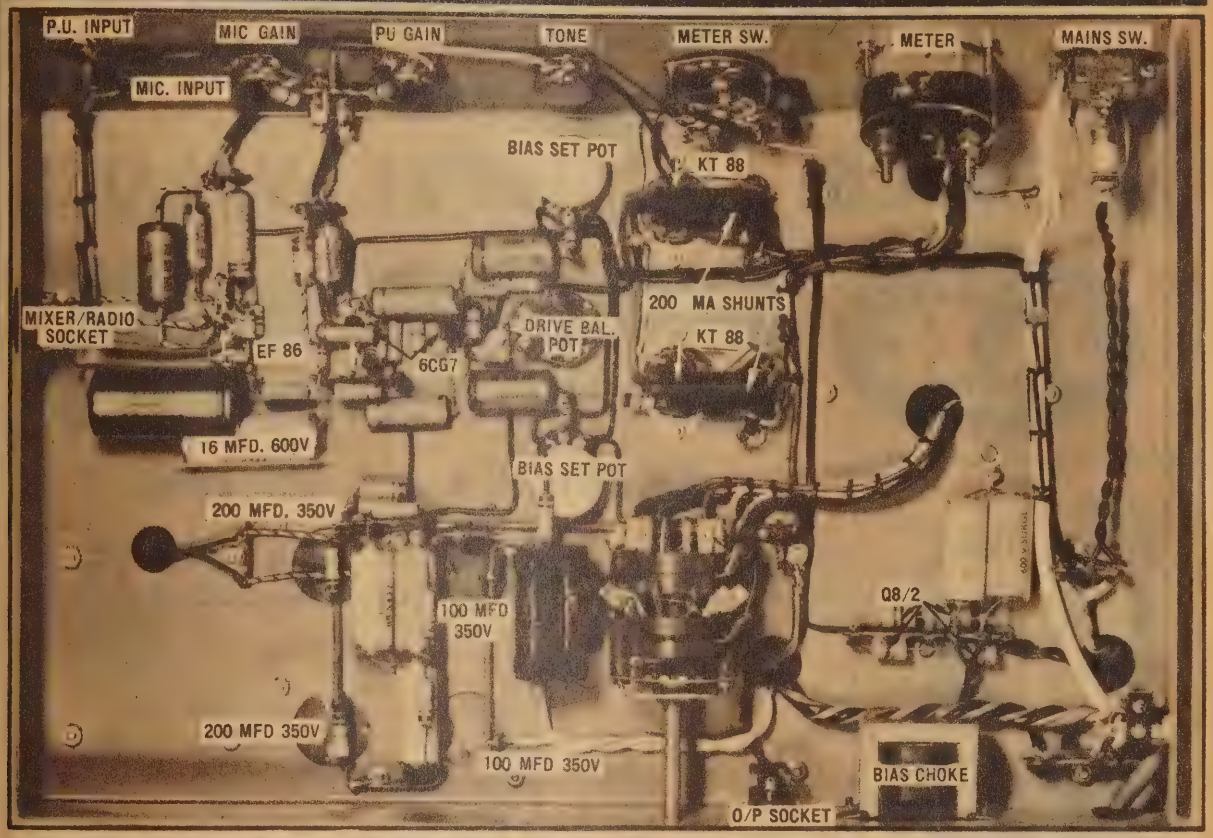

A good idea of the underchassis wiring and placement of minor components can be obtained from this picture. The two KT88 sockets are towards the top of the picture, almost central, immediately above the impedance selector switch. The EF86 socket is at extreme left of the picture.

and finish of windings should be strictly observed.

In this case we have avoided the use of open connectors for the various secondaries, for two very good reasons. Firstly, they can be confusing and lead to error. Secondly, the voltages produced across the secondary circuit may be every bit as lethal as the power mains.

SPECIAL SWITCH

In our prototype amplifier we installed a special rotary switch, produced by Paton Electric Pty. Ltd. This effects the necessary interconnection as it is rotated and makes the desired impedance available at the turn of a knob.

For a permanent installation, it would probably be sufficient to interconnect the windings as required, without provision for switching.

The remainder of the amplifier ahead of the output valves is fairly straightforward, but the general features are worthy of some comment.

As already explained, the class B1 output valves do not require a specially low impedance input. The grids are, therefore, fed from a pair of conventional triodes, operating in push-pull, and with fairly low values of plate load.

A 6CG7 twin triode makes an excellent pair of drivers and, in the circuit shown, provides ample swing for the KT88 grids.

Ahead of this is another 6CG7, one triode serving as a conventional phase splitter, and the other half as a voltage amplifier feeding the phase splitter.

The phase splitter uses 33K resistors in the anode and cathode circuits, and it is suggested that these be matched to within five per cent to ensure balanced output to the push-pull driver stage. The triode amplifier has a voltage gain of about 16, which brings the sensitivity to a level appropriate for volume control, and to receive the input from a crystal pickup, radio tuner or microphone preamplifier.

A simple top-cut tone control is provided in the anode circuit of this same triode amplifier, the constants chosen giving an adequate degree of control.

In practice, such a control is often handy to "round off" unpleasant voices or unduly shrill music, while it can also minimise feedback where this involves peaks in the treble register.

SIMPLE MIXER

A simple mixer network is incorporated in the triode grid circuit, using two volume controls and two isolating resistors. One section connects to the pickup input, and the other to the output of the microphone pre-amplifier stage.

Something under 400 mV of signal is required at the pickup terminals to drive the amplifier to full output. There should be no difficulty in obtaining this from a standard mono crystal pickup.

To have provided for a magnetic pickup would have involved at least one extra valve giving the requisite compensation and gain.

The pre-amplifier is a pentode-connected EF86 or Z729. The low noise and rigid construction of such valves shows to good advantage in this application. There is no problem with noise or microphony, and no need to resort to shock mounting of the socket.

HUM

However, it is necessary to take all the usual precautions to avoid hum pickup. As implied by the circuit, the entire input network should follow the now well-established practice of single point earthing. A solder lug firmly secured under a socket mounting bolt, and making good contact with a cleaned area of the chassis will make a good earth point.

To this is returned the 4.7M grid resistor, the cathode bias network, the screen by-pass, the central shield of the socket, and the shielding braid of the co-ax cable running to the microphone input socket. This latter should be insulated from the chassis by means of the insulating washers supplied, the braid connecting to the "earthy" side of socket, but not to the chassis.

Another precaution concerns the heater line. This is shown earthed on one side, rather than centre tapped, and this seems to be quite satisfactory in itself. However, while a single heater line

(Continued on Page 71)

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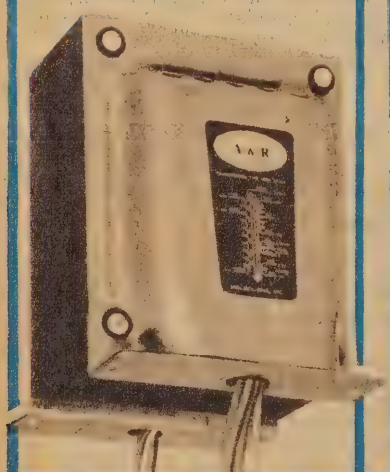
VLN 34 Mounting 60-125 mA



VLN 38 Mounting 125-200mA

• Latest Vertical Cover Styling with simplified chassis mounting. • Finished in durable Silver-Grey baked Enamel. • Contrasting Black Cores. • Permanent colour code affixed. • Tapped Primaries 6.3V Rectifier Heater winding with 5V Tap. • Full rated voltages all windings. • Varnish impregnated. • Leads anchored securely. • Low temperature rise.

Type P. T.	D.C. mA.	H.T. Volts Per Side	Rect. Fil.	Other Fils.
1992	30	150-0-150	—	6.3v. 1.7a.
1993	50	225-0-225	—	6.3v. 2a.
1880	60	250-0-250	6.3v. 1a. tap at 5v. 2a.	6.3v. 2a.
1881	60	285-0-285	6.3v. 1a. tap at 5v. 2a.	6.3v. 2a.
1882	60	325-0-325	6.3v. 1a. tap at 5v. 2a.	6.3v. 2a.
1883	60	385-0-385	5v. 2a.	6.3v. 2a.
1884★	80	250-0-250	6.3v. 1a. tap at 5v. 2a.	6.3v. 2a., 6.3v. c.t. 2a.
1885	80	285-0-285	6.3v. 1a. tap at 5v. 2a.	6.3v. 2a., 6.3v. c.t. 2a.
1886	80	300-0-300	6.3v. 1a. tap at 5v. 2a.	6.3v. c.t. 2a., 6.3v. c.t. 2a.
1887	80	325-0-325	6.3v. 1a. tap at 5v. 2a.	6.3v. 2a., 6.3v. c.t. 2a.
1888	80	385-0-385	5v. 2a.	6.3v. 2a., 6.3v. c.t. 2a.
1889	100	285-0-285	6.3v. 1a. tap at 5v. 2a.	6.3v. 2a., 6.3v. c.t. 2a.
1890	100	300-0-300	6.3v. 1a. tap at 5v. 2a.	6.3v. c.t. 2a., 6.3v. c.t. 2a.
1891	100	325-0-325	6.3v. 1a. tap at 5v. 2a.	6.3v. 2a., 6.3v. c.t. 2a.
1892	100	385-0-385	5v. 2a.	6.3v. 2a., 6.3v. c.t. 2a.
1893	125	285-0-285	6.3v. 1a. tap at 5v. 2a.	6.3v. 2a, 6.3v. c.t. 2a.
1894	125	300-0-300	6.3v. 1a. tap at 5v. 2a.	6.3v. c.t. 2a., 6.3v. c.t. 2a.
1895	125	325-0-325	6.3v. 1a. tap at 5v. 2a.	6.3v. 2a., 6.3v. c.t. 2a.
1896●	150	250-0-250	6.3v. 1a. tap at 5v. 2a.	6.3v. c.t. 2a., 6.3v. c.t. 2a.

Type P. T.	D.C. mA.	H.T. Volts Per Side	Rect. Fil.	Other Fils.
1919†	125	300-0-300	6.3v. 1a. tap at 5v. 2a.	6.3v. c.t. 2a., 6.3v. c.t. 2.5a.
1927	125	385-0-385	5v. 2a.	6.3v. 2a., 6.3v. c.t. 2a.
1928	150	285-0-285	6.3v. 1a. tap at 5v. 2a.	6.3v. 2a., 6.3v. c.t. 2a.
1929	150	325-0-325	6.3v. 1a. tap at 5v. 2a.	6.3v. 2a., 6.3v. c.t. 2a.
1930	150	350-0-350	6.3v. 1a. tap at 5v. 2a.	6.3v. 3a., 6.3v. c.t. 3a.
1931	150	385-0-385	5v. 3a.	6.3v. 3a., 6.3v. c.t. 3a.
1932	175	285-0-285	5v. 3a.	6.3v. 3a., 6.3v. c.t. 3a.
1933	175	325-0-325	5v. 3a.	6.3v. 3a., 6.3v. c.t. 3a.
1934	175	350-0-350	5v. 3a.	6.3v. 3a., 6.3v. c.t. 3a.
1935	175	385-0-385	5v. 3a.	6.3v. 3a., 6.3v. c.t. 3a.
1783	180	410-0-410	5v. 3a.	6.3v. c.t. 4a., 6.3v. c.t. 5a.
1936	200	285-0-285	5v. 3a.	6.3v. 3a., 6.3v. c.t. 3a.
1937‡	200	300-0-300	5v. 2a.	6.3v. 3a., 6.3v. c.t. 3.5a.
1938	200	350-0-350	5v. 3a.	6.3v. 3a., 6.3v. c.t. 3a.
1939	200	450-0-450	5v. 3a.	6.3v. 3a., 6.3v. c.t. 3a.

★ Mullard 2-Stereo-2 Amplifier. ● Mullard 7w Stereo Amplifier.
† Mullard 5/10 Amplifier ‡ R, TV and H. Stereo.

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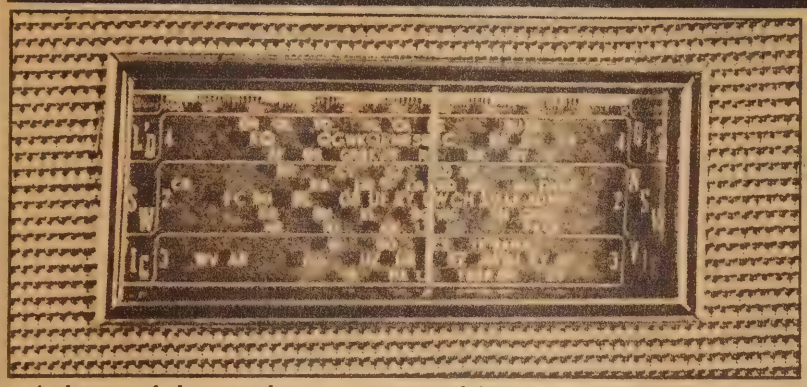
CABINET FOR THE TRANSISTOR 8



A close-up of the escutcheon we constructed from commercial profile moulding. Finished in gold anodised aluminium with a walnut stripe it matches well with readily available knobs.

The cabinet on page 56 which houses our new Transistor Eight Receiver is one of several possible designs which may occur to the individual. Its style and method of construction represent some departure from previous suggestions we have made, and sufficiently different to warrant some discussion. The final result is, we feel, particulraly pleasing.

One of our ever-present worries, associated with cabinet design, is the problem of how to cover or finish the cabinet when the basic woodwork has been completed. We have usually painted or lacquered the exterior or sometimes covered the box with leatherette or vinyl coated fabric.

The painted finish somehow or other other always seems to make the cabinet look just what it is; home made. A really professional appearance is most difficult to obtain without a great deal of sanding and filling, and even then the painted surface will not take the wear expected of a bakelite or plastic surface.

FABRICS

Much better results may be obtained by utilising the vinyl covered fabrics currently available. There are some most interesting designs, as well as attractive plain finishes, in the range.

However, it is often very difficult to achieve a good finish with this material unless great pains are taken to see that the corners are straight and the joins accurately made. This seems easier than it really is, especially if the cabinet is oddly shaped or the surface large.

In many respects, contact adhesive is the best to use. There is no need to clamp the two surfaces together while they dry, since immediate adhesion occurs at the moment they touch. This is all very well for two rigid surfaces, such as two pieces of wood, but when one of the surfaces is a large, floppy piece of fabric, it may be difficult to get it in the right position just prior to making contact.

If the fabric is misplaced the first time it must be torn off, and the process repeated. This is very tedious and time consuming, and the fabric may be damaged into the bargain.

The alternative is to use some slow drying cement, and somehow hold the material in place until it dries. Again this is fairly easy with flat surfaces, but difficult to arrange with curves or corners. Particularly difficult are small turnovers on corners, and contact adhesive may be the only satisfactory answer.

Nevertheless, some most interesting and varied results are possible with these fabrics. Corners and edges may be dressed with gold anodised mouldings, and stained and laquered wood mouldings, of various shapes.

Keeping in mind these difficulties, we looked further afield for a possible substitute for vinyl coated fabrics.

The answer seemed to be the laminated plastic materials which are so popular nowadays with furniture makers. These materials, of which Laminex, Formica and Panelyte are examples, are comparatively easy to work and have a finish that could rarely be matched by the average hobbyist.

Laminated plastic board, like vinyl coated fabric, has the ability to hide a multitude of sins, and may be placed over the roughest work to give it a professional finish.

Laminated plastic board is fixed in place by means of contact adhesive. However. unlike vinyl coated fabric, it is rigid and may be pre-cut square, facilitating the lining up of edges. Nor is it necessary to make any foldover joints on corners, the surfaces being simply butted together and planed.

NO SECOND CHANCE

Against this it has a disadvantage in that, once placed, it cannot be removed without being damaged. However, this is not as serious as it may seem. The fact that it can be cut squarely and positioned prior to sticking, or that it may be stuck in position and then planed, to a large extent precludes the possibility of any adjustment being necessary.

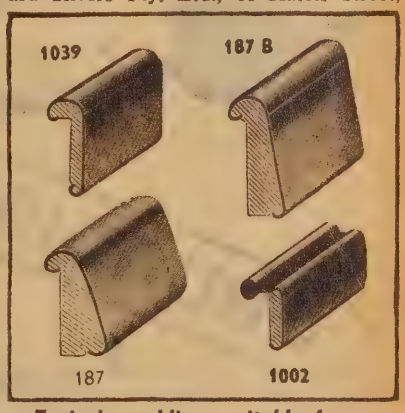
The use of laminated plastic board becomes more attractive due to these boards being available in a very realistic wood grain finish. This, of course, is a matter of taste, as some may prefer plain or patterned colour finishes.

One of the greatest disadvantages in using laminated plastic board is the cost, which is quite high compared with other covering materials. However, in the case of the present project the quantity used is small and the cost inconsequential compared with the rest of the set.

Having settled on the covering material for the cabinet proper, we went a step further and mocked up a front panel using a piece of "Tygan" speaker fabric as covering material. The result was so pleasing that it was decided to retain this material as a covering medium for the panel.

The next problem was the dial escutcheon. The unit normally supplied with the dial we used is of brown moulded bakelite and hardly suitable for use with the contemporary cabinet we had in mind. It was while pondering on this problem that we hit on the idea of using one of the modern anodised aluminium covered wood moulds to make our own escutcheon.

These are available in a wide range of profiles and designs, and some of the more suitable types for this requirement are reproduced. Those we used bear the brand name Schock and are available from the Sydney agents, Howard Silvers Pty. Ltd., of Harris Street,



Typical mouldings suitable for an escutcheon. We used No. 1002 (Diagrams by courtesy Howard Silvers Pty. Ltd).

Ultimo, N.S.W. The above firm kindly supplied samples, information etc., to assist us in our selection.

While on the subject of mouldings, we would like to comment on the infinite variety of mouldings now available to meet almost every cabinet finishing requirement. Escutcheons, edge grain, etc., need no longer present a problem

(Continued on Page 74)

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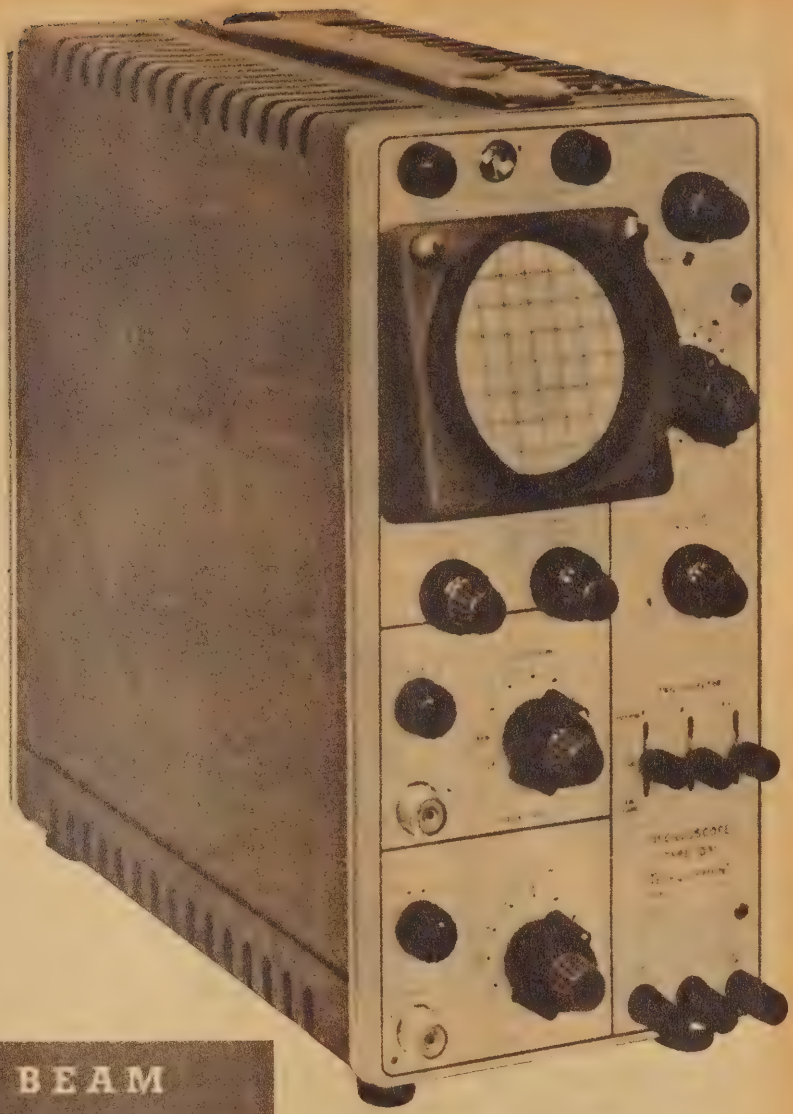


DOUBLE BEAM Serviscope

A high impedance x 10 divider probe is available.
Input resistance 10 M.ohms
Input capacitance 8 pF approx.

Y AMPLIFIERS

Frequency response	D.C.—6 Mc/s (approx.—3dB) adjusted for optimum pulse response.
Maximum Sensitivity	100 mV/cm. at all frequencies.
Rise Time	·06 μsec. (Less than 2% overshoot).
Maximum Y deflection	5 cms. at all frequencies.

INPUT ATTENUATORS

9 position frequency compensated, direct reading in Volts/cm.
100 mV., 200 mV., 500 mV., 1V., 2V., 5V., 10V., 20V., 50V./cm.
Imput Impedance 1MΩ+30 pf (approx.).
Voltage Measuring Accuracy ±5%.

TIME BASE

18 preset calibrated Sweep Speeds.
500, 200, 100, 50, 20, 10, 5, 2, 1 milliseconds per cm.
500, 200, 100, 50, 20, 10, 5, 2, 1 microseconds per cm.
} at minimum. x expansion.
Variable control covering intermediate speeds.
Slower speeds can be obtained by internal adjustment.
Time measurement accuracy ±10%.

X EXPANSION

Continuously variable up to over 10 screen diameters (60 cms.), Trace expands symmetrically about centre of screen. X-shift control positions any portion of expanded trace on screen. Direct access to X-amp.

TRIGGERING

Automatic for repetitive signals up to about 1 Mc/s.

TRIGGER LEVEL CONTROL

Selects any point on input signal slope for repetitive, random, or single shot triggering.

TRIGGER SELECTOR

Positive, negative, or T.V. Line or Frame (+ve or —ve) internal or external.

VOLTAGE CALIBRATOR

Stabilised 1 v.p.p. (±2%) 50 c/s. squarewave for checking voltage accuracy.

CATHODE RAY TUBE

3½" flat faced tube operated at 1·6 KV.
Screen phosphor, P.1 Medium Persistence fitted as standard. Long Persistence P.7 and Short Persistence (Photographic) P.11 also available. Tube face tilted at correct viewing angle. Removable filters are fitted to improve contrast at high ambient illumination. Edge lit illuminated graticule.

COOLING

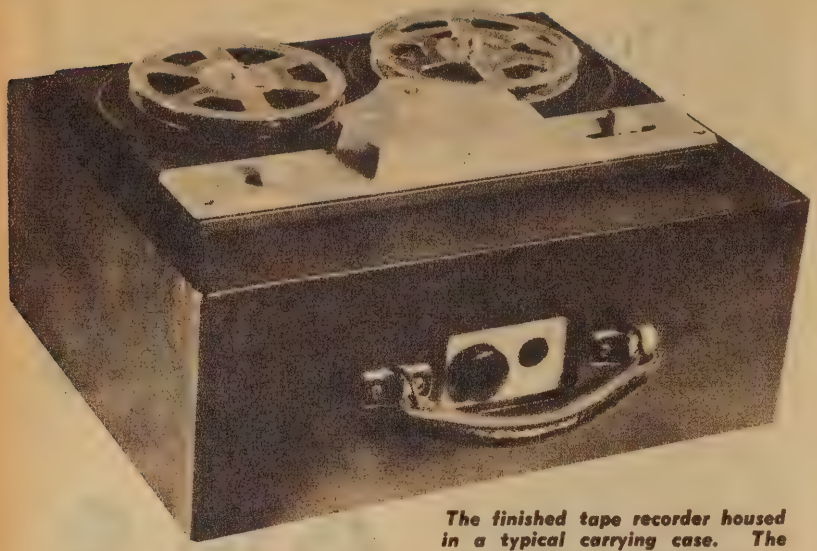
Convected air thermo-syphon cooling.

SUPPLY VOLTAGE

Normally 200-250 V. 50-1000 c/s. Or 95-115 V., other voltages to special order.

DIMENSIONS

D.31—6½" wide×13" high×13" long (16·5 cms.×32·5 cms. ×32·5 cms.) Weight: 26 lb. (12 kilos).
D.31R—19" rack mounting, 7" panel, 14" rack depth.



The finished tape recorder housed in a typical carrying case. The volume control and level indicator are mounted on the recessed panel under the carrying handle. The speaker cut-out and the microphone inlet socket are on the rear of the case.

Simple, Economical Tape Amplifier

Here are the details of a small utility tape recorder designed around the recently released B.S.R. "Monardeck." It is compact, moderately priced and convenient to use, and should fill the need for a small general-purpose tape recorder.

FOR some time now we have been aware of the two more or less diverging applications found for tape recorders in our modern world. One application is in the field of high fidelity music recording. Obviously this application demands a recorder with rather pretentious features, in order that quality and versatility shall be preserved.

Recorders in this field tend to become large, elaborate in electronic circuitry, and rather costly, either to make or buy. They are, therefore, largely out of the question for the usual domestic situation, where a smaller, more moderately priced and less versatile recorder is quite satisfactory.

COMMON USES

This more modest application is that in which recorders are used for general-purpose recording of family events, parties, club functions, play rehearsals, speeches and business dictation. It is here also that the features of portability and cheapness tend to outweigh those of extreme quality and versatility.

This is not to say that the cheaper type of recorder gives results that are unacceptable in quality or lacks operational functions. On the contrary, most recorders in this category are quite satisfactory in this regard. What it does mean is that they are designed as simple, economical units suitable for most utility recording applications.

It is into this more modest category, then, that the recorder featured on these pages, falls. We had, for some time, been toying with the idea for such a recorder, and our ideas finally crystallised, when the Monardeck was announced.

This deck is a small unit running at 3¾ inches per second. It takes 5¾ inch diameter reels and records half-track with the standard configuration of top track left-to-right. It is a two-head deck and uses a single, shaded-pole induction motor drawing a mere 10 watts.

The deck provides for fast forward and reverse as well as normal running, the fast speeds being achieved by mechanical shifting of drive ratios. A record replay changeover switch is supplied on the deck. This is mechanically interlocked with the speed change mechanism, to prevent accidental erasure. Only one switch wafer is normally supplied with the deck, but the extra wafer we used will be made available at a small extra charge for intending builders of this unit.

The head supplied with the deck for recording and replay is a small shielded type. For the quoted frequency response of 30 to 8,000 cycles from a tape recorder using this head, rather large amounts of bass and treble boost must be provided by the amplifier used with it.

ATTRACTIVE PRICE

The deck is obviously not elaborate, but it is relatively inexpensive, and provides all the features required for general utility recording. It thus lends itself well to the modest type of instrument mentioned earlier. With this in mind, we set out to design an amplifier around the deck, with the interests of cheapness and portability in view.

Considering the large amounts of boost required to achieve the 30 to 8,000 cycles response, we decided to restrict the bandwidth to something less than this figure. This is because an amplifier capable of providing the required boost would be rather elaborate and expensive, and would tend to defeat our aims of economy and simplicity. We felt that a great many applications would be quite adequately served by a more modest bandwidth.

The results of our efforts can be seen in the unit pictured in the photographs. It gives results at least comparable with a modern good quality mantel radio, but occupies very little more space than that required for the deck itself. It is thus extremely portable, and, since only three valves and a "magic eye" level indicator are used, is quite low in cost.

RESPONSE

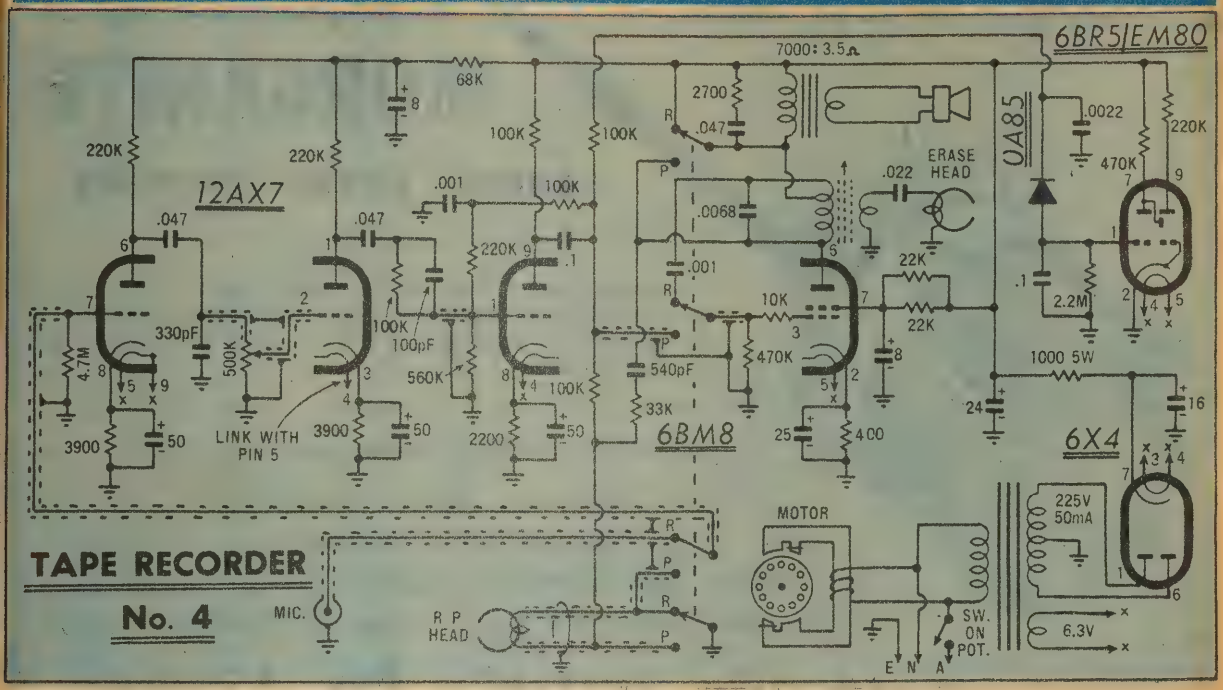
The actual response obtained was 3 db down at 250 cycles and 5 Kc/s, which, we feel, is quite satisfactory considering the simplicity of the circuit and the application envisaged for it. The bass roll-off slope is not steep and the response is well balanced. Thus, quite acceptable sound quality may be obtained with the recorder.

The amplifier proper is designed around a 12AX7 twin triode and a 6BM8 triode pentode. By a rather ingenious arrangement these two valves are able to perform all the necessary recording and playback functions in a comparatively simple circuit.

For both recording and playback the two 12AX7 triodes are operated in cascade, and feed the triode section of the

By Jamieson Rowe

USE OF DOUBLE VALVES SIMPLIFIES CIRCUIT



Here is the circuit of the new economy tape recorder. The design uses only four valves, including the level indicator tube and the rectifier. It is quite compact and answers the need for a low cost portable recorder.

6BM8. However, since only a moderate amount of audio power is required for recording, the 6BM8 triode is able to operate directly into the recording head, leaving the pentode section for use as a bias oscillator.

For playback, when the bias oscillator is not required, the pentode section becomes a normal power output stage, driven from its own triode section. There is thus plenty of audio power available for all normal playback requirements.

Looking at the circuit in greater detail we find that the first two stages of the amplifier, utilising the twin sections of the 12AX7 are fairly normal, with the volume control potentiometer between them. The volume control is bypassed with a 330 pf capacitor to lower the gain at very high frequencies.

BIAS FREQUENCIES

This does not affect the audio high frequencies appreciably, but prevents bias signal (picked up by the input circuitry on record) from being amplified and overloading the final stages. If this were not done, the overload would cause distortion of the audio signal. This can cause a serious loss of power in any recording circuit if it is not controlled.

The coupling circuit from the final section of the12AX7 to the triode section of the 6BM8 incorporates an isolating resistor of 100K shunted by a 100 pF. The resistor is used to maintain a fairly constant high grid impedance for the 6BM8. Thus the feedback over this stage is constant except at high frequencies, where the shunting capacitor becomes effective and the feedback is reduced.

More specifically, the feedback over the 6BM8 triode stage is designed to produce a peak in the response at about 7 Kc/s. This lifts the treble response of the amplifier in both record and replay positions.

The bias and erase oscillator uses the 6BM8 pentode in a Hartley circuit, using a readily available commercial coil, the Q-Plus type OME. However, any other coil having similar characteristics would be equally suitable. The type OME is fitted with a 10 ohm secondary winding.

Since the erase head used in this deck has an impedance of about 140 ohms, some special arrangement had to be made to ensure that the maximum erase power was fed to the head. This is the reason for the capacitor in series with the head, the value being chosen to set up a series resonance at the supersonic erase frequency, thus producing maximum erase current.

The appropriate bias signal is fed to the recording head from the plate of

PARTS LIST

1 Power transformer, 225 volts a side at 50 mA; 6.3 volts at 2 A.
1 Speaker transformer, 7,000 ohms to 3.5 ohms.
1 Bias oscillator coil (type OME or similar)
1 Elliptical speaker (type 10-3 G or similar)
Valves.
6X4, 6BM8, 12AX7, EM80/6BR5.

CAPACITORS

1 16 mfd. 300 volt working electrolytic.
1 24 mfd. 300 volt working electrolytic.
2 8 mfd. 300 volt working electrolytic.
3 50 mfd. 12 volt working electrolytic.
1 25 mfd. 25 volt working electrolytic.
1 0.1 mfd. volt paper.
3 0.05 mfd. 400 volt paper.
1 0.22mfd. 200 volt paper.
1 0.0068 mfd. 400 volt paper.
2 0.001 mfd. 400 volt paper.
1 540 pF 400 volt ceramic, 1 330 pF 200 volt ceramic or paper.
1 100 pF 400 volt ceramic.

RESISTORS

1 1000 ohm 5 watt w.w
2 22K 1 watt carbon.
2 220K 1 watt carbon.
2 220K ½ watt carbon.
4 100K ½ watt carbon.
1 100K 1 watt carbon.
2 470K ½ watt carbon.
1 560K ½ watt carbon.
1 4.7 meg. ½ watt carbon.
1 33K ½ watt carbon.
1 10K ½ watt carbon.
1 2.7K 1 watt carbon.
2 3.9K ½ watt carbon.
1 2.2K ½ watt carbon.
1 400 ohm 3 watt w.w
1 500K potentiometer.

SUNDRIES

3 noval valve sockets, 1 min. 7 pin socket, 3 8-lug tagstrips, 1 each of the 7, 6, and 5 lug tagstrips, 2 4-lug tagstrips, and 1 3-lug tagstrip. Microphone connector, mains cord and plug, grommets, nuts and bolts.

NEW! The latest addition to the comprehensive range of

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Resistance: 1,000 ohms.—5 megohms. Rating: To $1\frac{1}{2}$ watts.

Production prototype samples provided on request

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the oscillator via a 540 pF series capacitor and 33K resistor. The actual level of bias can be adjusted by varying the value of these series components.

In addition to the obvious switching functions, we found it necessary to arrange for the bias oscillator coil to be shorted out when the system was switched to the replay condition. This is essential, in order to prevent oscillation at the erase frequency, due to magnetic coupling between the erase head and the record-replay head.

With the bias oscillator coil left in the output circuit of the replay amplifier, there is a feedback path from this coil, to the erase head, then to the replay head via magnetic coupling, and thus to the input of the amplifier. And, since we have deliberately resonated the erase circuit at the bias frequency, the system will oscillate at this frequency when the amplifier gain is advanced.

COMPENSATION PROBLEM

We came upon this trouble initially when we attempted to provide suitable amounts of treble boost for frequency compensation. Until we discovered the cause, and arranged for the bias coil to be shorted out, even reasonable amounts of treble boost caused trouble.

The "magic eye" circuit used to monitor the level of the signal during recording is quite conventional. It uses a small noval based indicator type EM80/6BR5, which is a single fan type indicator. The indicator is left in circuit during replay to simplify switching.

A final point about the circuit is in connection with the power supply. This uses a 6X4 valve rather than a silicon diode, reducing the initial cost slightly. The filtering uses a 1,000-ohm 5-watt resistor rather than a filter choke to conserve space. Since the drain of the circuit is moderate and not especially critical regarding regulation, this is quite permissible.

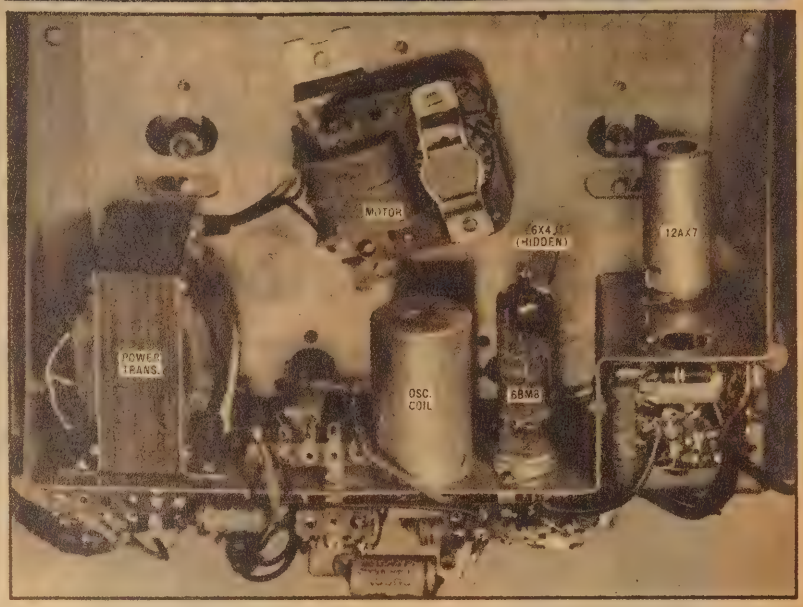
A few points about the mechanical aspect of the unit can now be discussed. The oscillator coil is placed quite close to the output valve to shorten the length of leads which may radiate. The input stages are similarly placed close to the record-play switch to reduce lead length.

We found it desirable in the interests of stability to perform the output switching on a separate switch wafer to that used for the input switching. In addition, we made a shield plate out of aluminium sheet and assembled the switch with the shield between the two sections. The shape and position of this shield can be seen from the photographs.

As can be seen from the photographs the recorder circuitry is built on a small chassis which attaches to the underside of the deck. The chassis is rather like an elaborate bracket, arranged so that all the major components are set out compactly around the motor and capstan bearing of the deck.

The power supply, output stages and bias oscillatory circuitry is mounted on the main section of the chassis, while the input circuitry is arranged on a smaller section near the record/play switch of the deck. This procedure allows critical leads to be kept as short as possible, helping to prevent instability.

CHASSIS MOUNTS BELOW DECK



Here is a view of the underside of the recorder, showing the way in which the chassis attaches to the deck. The power transformer and shielded 12AX7 valve are visible, with the 6X4 rectifier hidden by the 6BM8 output valve.

SPEAKER SPACE

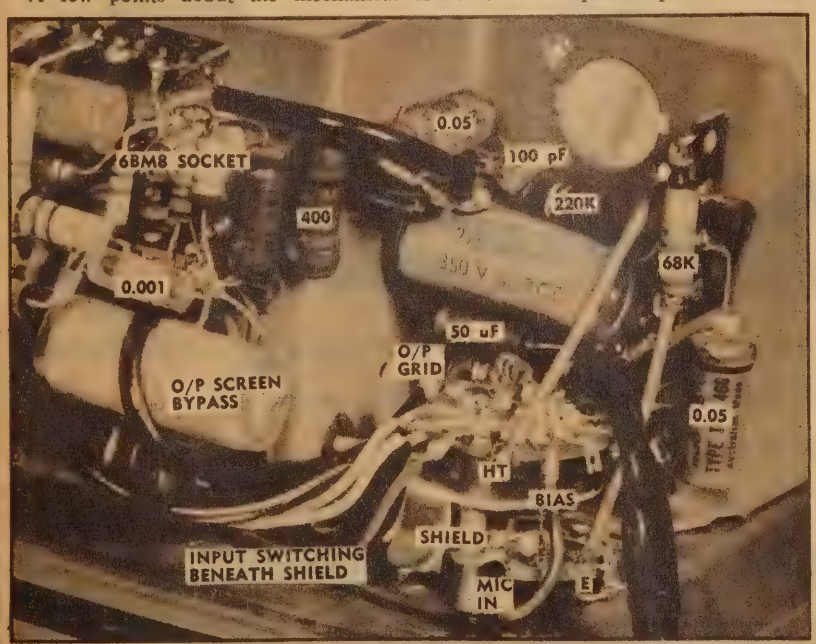
The chassis was purposely kept to the front side of the underneath of the deck. This is to allow the fitting of a compact speaker in the space near the motor. Thus the complete recorder can be included in a box little larger than the deck, with the speaker mounted on the rear side.

The "magic eye" level indicator and its associated components, together with the volume control, are mounted on a small sub-chassis. This is to allow the control and indicator to be mounted in a suitable position on the box. We would suggest mounting these components on the front face of the box, as this position would seem to be the most convenient.

An alternative spot for the gain control/level indicator bracket, would be under the deck supporting shelf, just in front of the deck, and this may be more convenient in some cases. Much depends on how compact it is desired to make the cabinet.

A good idea of the underchassis wiring can be obtained by reference to the

(Continued on Page 106)



This view of the switch wiring shows the shield plate added to the switch. The head and input switching is done on the switch section nearest the tape deck, while the upper section is used for output grid and plate circuit switching.

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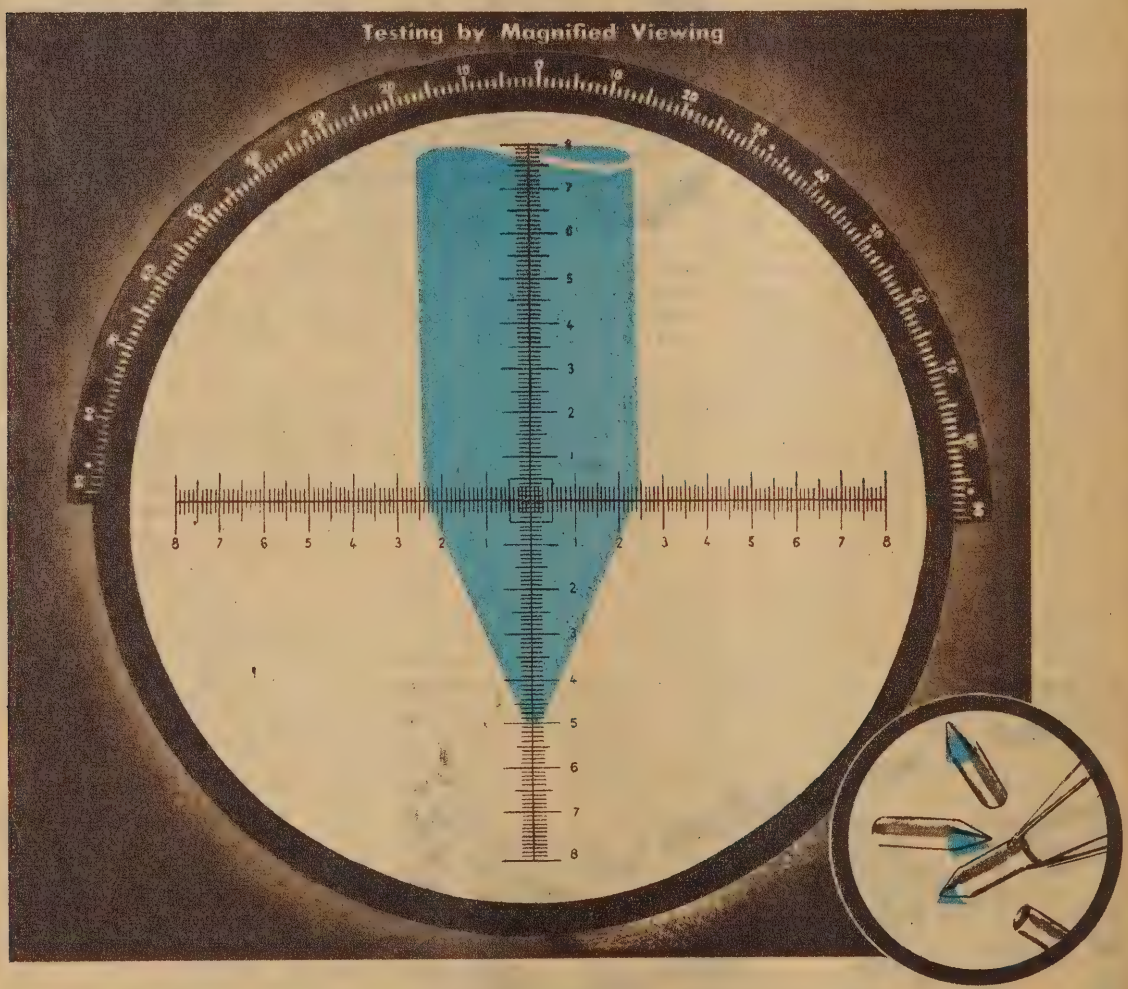

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Here's your answer, Tom!

This month, as we promised in the last issue, we are concluding the discussion of gramophone pickups with a brief look at stereo types. The basic methods of transduction used in these pickups are the same as those used in the mono types discussed last month, but stereo poses some other probems.

By Jamieson Rowe

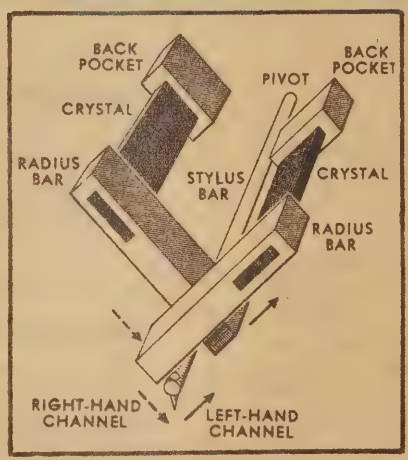
THE main additional problem introduced by single-groove stereo to the construction of a suitable pickup is that of channel separation—that is, separation of the two separate electrical signals which are combined in a composite mechanical signal in the record groove.

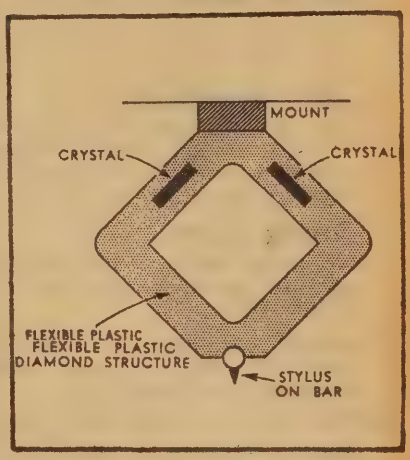
Perhaps, before we go too deeply into this matter, it would be advisable to refresh our minds about the general principles of single-groove stereo.

LATERAL MODULATION

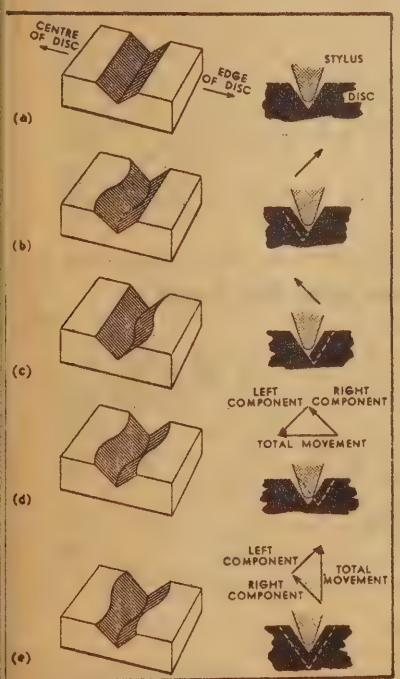
As you probably know, the information of a normal "mono" record is imparted to the groove by way of side-to-side or lateral modulations. This is not the only way of modulating the groove, however, as modulation to the depth of the groove is also possible.

Thus, one method of recording the two signals needed for two-channel stereo would be to modulate the groove vertically for one signal and laterally for the other channel.





Here are two of the types of construction used for crystal stereo pickups. They use different methods for channel separation. One uses radius bars and pressure contact, and the other uses a diamond shaped plastic coupling piece.



The 45-45 recording system. (a) No modulation. (b) left channel only modulated. (c) right channel only modulated. (d) both modulated, equal amplitudes and in phase. (e) both modulated, equal amplitudes but out of phase.

Unfortunately this system has certain drawbacks, one being that the rumble of a normal turntable has a much greater component in the vertical direction than in the lateral direction.

PINCH EFFECT

In addition, the "pinch effect," which already necessitates a high vertical compliance in a mono pickup, may cause serious channel interaction in a stereo pickup of this type (particularly as the vertical compliance must now be identical to the lateral compliance).

These effects cause the signals for the two channels to be subject to different influences in the reproductive "chain of events." In other words, the signals are treated asymmetrically. Since the stereo effect is compromised, if the signals differ in quantities other than the original stereo information, a system which is inherently more symmetrical is desirable to record the stereo signals.

The system which has been decided upon is that in which the two signals are recorded on the groove to the so-called "45-45" configuration. In this system the groove modulations for the two signals are still mutually at right angles, but the whole system has been rotated by 45 degrees.

As the diagram shows, the information from one channel moves the pickup stylus to the right at an angle of 45 degrees to the horizontal, while that of the other channel moves the stylus at 90 degrees to this direction. Thus a purely horizontal or vertical movement of the stylus corresponds to components of equal magnitude (and either equal or opposite phase) in both channels.

It is thus obvious that features of the recording system which tend to affect the vertical motion of the stylus (such as rumble, pinch effect) will produce equal effects in both channels. The same is true with regard to features affecting the horizontal motion of the stylus. The system thus treats both the stereo signals in the same way.

BASICALLY SIMILAR

So much for the basis of the modern stereo recording system. As before, pickups are made for stereo reproduction which use a variety of transduction methods. These methods are generally the same as those used in mono pickups. Thus there are crystal, variable reluctance and moving coil stereo pickups.

No doubt most of the other types of pickups could be (and in time probably will be) adapted for the reproduction of

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45-45 stereo discs, but, to date, the above three types have been the only ones which appear to have been used to any extent.

Perhaps the easiest type of pickup to adapt to stereo is the crystal unit (at least superficially so). Such a unit consists of two crystal slabs arranged so that stylus movement caused by each channel distorts one slab only. Thus the output of each channel appears across one slab.

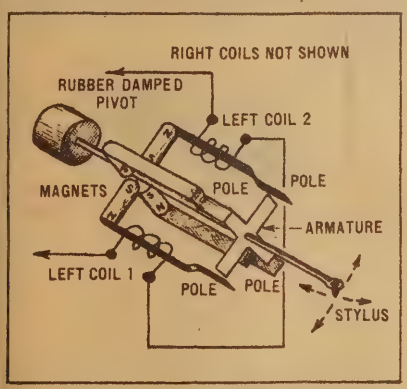
The difficulty lies in the coupling of the slabs to the stylus. This must be done in such a way that each slab receives only the mechanical signals intended for it. The problem has been attacked in a number of ways, two of which are shown in the second diagram.

RADIUS BAR

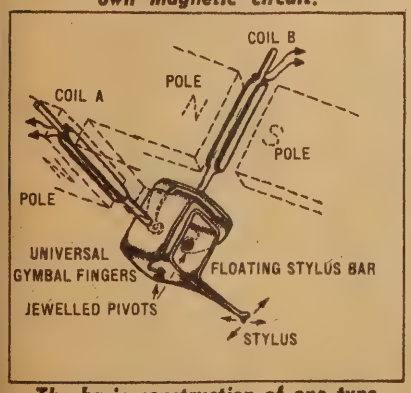
As you can see, one method involves a radius bar attached to each crystal slab. The radius bars are maintained in contact with the stylus bar by the pressure due to the tracking weight. The signals from each channel act upon the stylus and particular radius bar concerned to twist the desired slab.

The other method uses a diamond-shaped coupling piece made out of a flexible plastic to separate the two signals. The stylus fits into a notch in the lower apex of the diamond and the bars are fitted into the two upper arms. Excursions of the stylus distort the shape of the diamond to twist the particular slab involved.

The next most popular type of stereo pickup cartridge is the variable reluctance. This is quite similar in construction to its mono counterpart, but has two sets of coils. In other words, there are two magnetic circuits, one for each channel.



Here is the basic construction of one type of variable reluctance stereo pickup currently available. As you can see, each coil has its own magnetic circuit.



The basic construction of one type of stereo moving coil pickup involves the use of a gymbals coupling unit.

The particular cartridge shown in the diagram has an armature shaped like a cross mounted on the stylus arm. The cross is mounted at 45 degrees to the horizontal, so that it looks like an "X." Four coils are arranged on pole pieces positioned near the extremities of the armature.

The magnetic circuit through the coils is completed through the stylus bar, which has a rubber damped pivot at its upper end. Small permanent magnets mounted at the upper ends of the poles provide the M.M.F. for the magnetic circuits.

When the stylus is moved in one direction, due to a signal from one recorded channel, the reluctance of the magnetic circuits through the two diametrically opposite coils in the line of motion is altered. Thus a voltage is generated in each and the two voltages are combined to form the output of one channel. Movement in the quadrature direction will similarly cause the other two coils to operate.

MOVING COIL

The final type of stereo pickup at present available is the moving coil pickup. This type operates on the same lines as its mono counterpart, with coil similar to that of a d'Arsonval meter coil. To ensure that each coil receives only the mechanical signal intended for it, however, a special mechanical coupling must be used.

In one current moving coil stereo pickup, the construction of which is shown in the diagram, a gymbals arrangement is used to perform this task. This is so arranged that when the needle moves due to one channel modulation, the particular coil involved receives the signal through the coupling, which uses the coupling pins to the other coil as a pivot.

When the needle moves due to the other channel being modulated, the reverse happens and the previously stationary coil is actuated by the needle. The gymbals unit thus acts as a sort of two-way universal joint. It separates the two channel components of the composite needle movement and passes them on to their respective coils.

And now, a few general points about stereo pickups. All stereo pickups currently available are fitted with stylii of about 0.0006 inches radius, as compared with the standard microgroove radius of 0.001 inches. They are usually operated with a playing weight of about 3 to 5 grammes less than their mono. counterparts.

In practice, a stereo pickup is generally suitable for reproducing mono records, as it has a smaller stylus radius and smaller tracking force. But a mono pickup is quite unsuitable for reproduction of stereo records, as it is too heavy (in general), has too large a stylus radius, and has far too little vertical compliance (again in general—some would be suitable in this regard).

The vertical compliance is necessary since, if it is not present, the stylus will "plough through" the vertical undulations of the groove, instead of following them.

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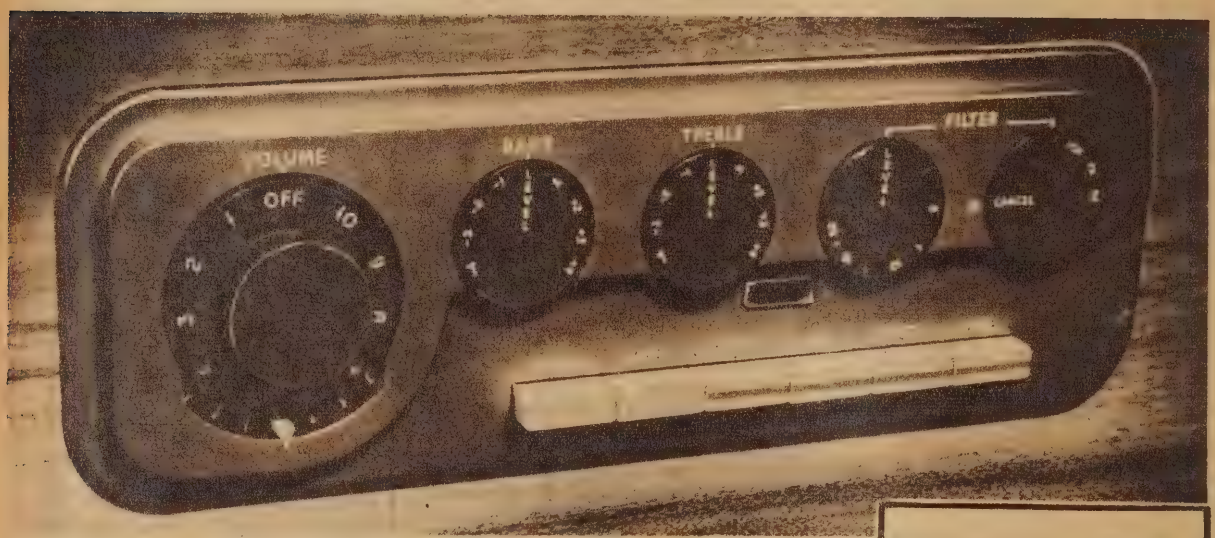

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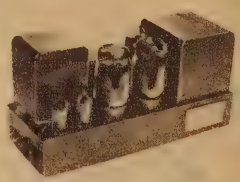

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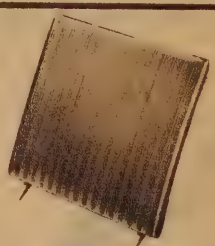

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FROM THE SERVICEMAN WHO TELLS

TV and transistor sets form the basis of this month's article. One case concerns a TV sound system and, another, a rather mysterious case of excessive flicker. In the transistor field there is a problem concerning transistor reliability, particularly in regard to the output stages.

AS I may have remarked on previous occasions, it is seldom that the sound section of a receiver produces a fault sufficiently interesting to make a story. In spite of the fears we may have entertained in the early stages, when FM was still something of a mystery, this part of the set has turned out to be the least of our worries.

And yet, have you ever stopped to consider that it may contain nearly as many parts as a small broadcast receiver? What's more, when one of these parts decides to turn temperamental, you may be faced with an intermittent which is no less aggravating, simply because it is confined to a relatively small section of the set.

In short, intermittents are much the same wherever one encounters them.

CONVENTIONAL DESIGN

So it was in the story I am about to relate. There was certainly nothing complex about the set. In fact, it was a very conventional circuit, and obviously made by a small manufacturer who was more interested in simplicity and reliability at a moderate cost than a complex set "with everything that opens and shuts."

In most respects it had been a most reliable set. A couple of valves had passed out in the first few months of its life but, after that, it had gone along merrily with no sign of trouble until a couple of months before I met up with it.

Then the sound section commenced to misbehave. Without warning, and slap in the middle of the favourite program, it suddenly dropped to a very low level and became badly distorted. The owner managed to flog enough volume out of it to follow the remainder of the picture, but only with considerable difficulty, due to the distortion.

BACK TO NORMAL

Naturally he was all set to call for assistance the following morning, but was rather taken aback when another member of the household switched the set on and produced perfect sound. Although the wisest thing might have been to call a serviceman anyway, he decided to hold off for a few hours and see whether the trouble re-appeared.

The hours lengthened into days, the days into weeks and, eventually, a couple of months went by without any further sign of the trouble. By this time the owner had almost convinced himself that there was nothing wrong with the set at all, that the trouble must have occurred at the transmitter or was due to some outside cause. Perhaps, deep down, he knew he was kidding himself, but it was easy to do nothing while ever the set continued to function.

Then the trouble occurred again, and with very much the same cycle of events. As before, it failed after several hours running one evening, the program being completed with the volume control flat out and everyone concentrating intently on the distorted dialogue. And, also as before, the set was back to normal in the morning.

By now the owner realised that the set was at fault. (He had checked it on the two other channels as soon as it failed, with identical results.) The question was: what to do about it? Could he convince a serviceman that there was something wrong with it, while it persisted in playing perfectly? And, more important, could it be found and fixed?

He was in this frame of mind when he approached me. I was able to assure him that such faults were not unusual (more's the pity!) and that we usually managed to track them down by one means or another. However, I pointed out that they could be sticky.

BEST APPROACH?

With these points clarified, we then had to decide how best to tackle the problem. Although the owner was not anxious to be without his set for too long, he agreed that it might be best to set it up in my workshop for a couple of days in the hope that it would "act up," and where I could come to grips with it if it did.

There was also a faint hope that it might show up when I went to collect it, but this was not to be. After listening to it for a little while, without observing anything unusual, I packed the whole thing, cabinet and all, into the truck and took it back to the shop.

There I set it up in a vacant corner where it could run for as long as might be necessary, tuned it to the most musical channel I could find, and went about my other jobs while waiting for something to happen.

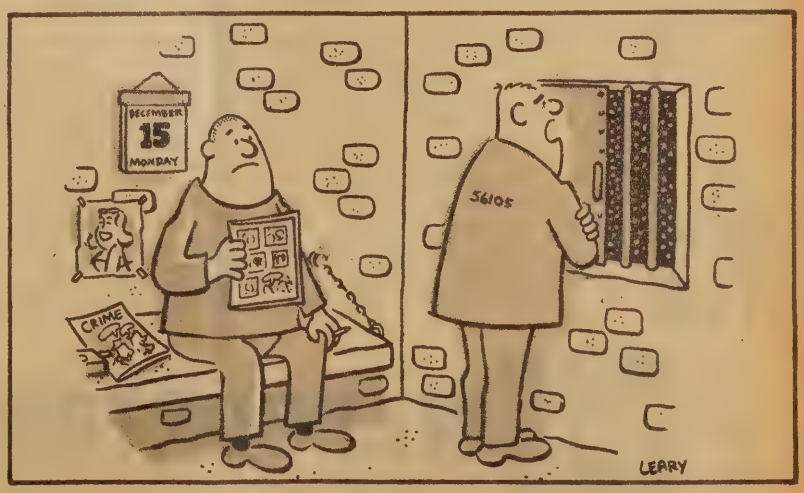
The set chortled away merrily for several hours and I was beginning to fear that it was going to prove stubborn. Then, just as the owner had described it, the volume suddenly dropped to whisper, and a very distorted whisper at that. Well, at least I had heard the effect and had some idea of what I was seeking.

GENTLY DOES IT

My next job was to get the chassis out of the cabinet and hope that the trouble was still present when I switched it on again. I worked as quickly as possible, and as gently as possible, and managed the job without any complications. But it was no use. When I switched the set on again it behaved perfectly.

I went over the chassis with the blunt end of a screwdriver, pounding at it in the vicinity of the sound circuits, but without result. Whatever the trouble was it didn't look like responding to mechanical vibration.

I now had two possible lines of attack. One was the fairly conventional one of letting the chassis run until it failed again, preferably with as many monitoring devices as possible connected to it in anticipiation. This usually works in the long run, but has the disadvantage that it may take a long time to eliminate all possible components, depending on how frequently the fault occurs and



"Was on a day just like this when I battled my way through 25 miles of snow to make that service call. Then this bloke came to the door laughing, told me he had forgotten to plug in the set." (Sylvania News.)

The WARBURTON FRANKI Page . . .

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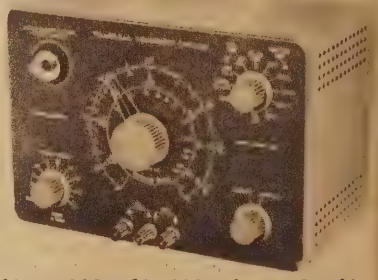
HEATHKIT T-4 Visual-Aural Signal Tracer Kit

This high-gain signal tracer is ideal for tracing RF, IF and audio signals in AM and FM receiver circuits and for checking the new transistor-type radios which can be damaged through ordinary testing procedures. This compact instrument contains a unique "noise locator" circuit that permits the technician to locate noisy and intermittent components in various circuits. The RF and audio inputs are combined in one handy probe. A switch mounted on the probe permits fast, easy selection of either RF or audio. Signal strength is indicated both aurally and visually by a 3½in PM speaker and an electron beam "eye" tube. A front panel slide switch disconnects the speaker from the output transformer allowing the T-4 to be used as a test speaker. This is particularly useful when checking radio or TV chassis where speakers have been left in the cabinet.

HEATHKIT C-3 Condenser Checker Kit

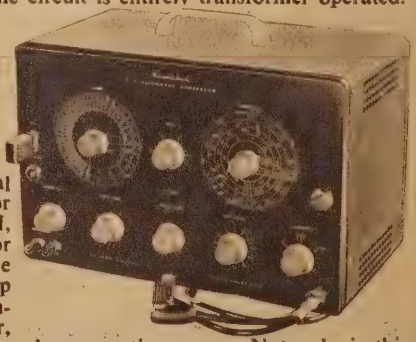


Check unknown condenser and resistor values quickly and accurately as well as their operating characteristics with this fine instrument. Capacity measurements are made in four ranges: .00001 mfd — .005 mfd; .001 mfd — .5 mfd, .1 mfd — 50 mfd, and 20 mfd — 1,000 mfd. Measures resistance from 100 ohms to 5 megohms in two ranges. All values read directly on the calibrated scale. An electron beam "eye" tube indicates balance and leakage. Leakage test provides switch selection of five test voltages, 25 volts to 450 volts DC. Spring return test switch eliminates shock hazard to operator by automatically discharging condenser after test. For safety of operation the circuit is entirely transformer operated.

HEATHKIT V-7A _ _ _ _ _ _ VTVM KIT

Specifications: DC Volts: 7 ranges 0-1.5 to 0-1500. Input resistance: 11 megohms. Sensitivity: 7,333,333 ohms per volt on 1.5v range. Accuracy plus-minus 3 per cent full scale. AC Volts: 7 R.M.S. ranges 0-1.5 to 0-1500. Frequency response (5v range): plus-minus 1 db, 42 c.p.s. to 7.2 mc. Accuracy plus-minus 5 per cent full scale. 7 peak-to-peak ranges 0-4 to 0-4000. Resistance: 7 ranges measures 0.1 ohms to 1000 megohms with internal battery. Size 7 3/8in x 4-11/16in x 4 1/8in.

HEATHKIT TS-4A TV Alignment Generator



Provides the essential facilities required for alignment of FM, monochrome TV or colour TV sets. The all-electronic sweep circuit employs a controllable inductor, which varies frequency by magnetic means. Not only is this device trouble-free and consistent in performance, it also requires very little power to provide wide range sweeps with excellent linearity. The sweep circuit operates on fundamentals covering the range of 3.6 mc. to 220 mc in four bands Features built in 5.5 meg. Crystal and Variable Marker Oscillators.

WARBURTON FRANKI

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how long it will condescend to remain in evidence while tests are made.

The time in this case is not so much working time, which might be quite short, but rather the period during which the set must remain in the workshop and out of the customer's lounge-room. Anything which might possibly shorten this is usually worth trying.

For this reason I decided to try a technique which I have used and written about on previous occasions; that of "doctoring" the set in an effort to simulate the fault as already observed. This is usually most beneficial when the fault has definite characteristics, as in this case where the drop in level and the amount of distortion were both easily remembered.

And so I set to work while the symptoms were still fresh in my mind. This part of the circuit was just as conventional as all the rest. The audio system used a 6BM8 as driver and output stage, the ratio detector was a 6AL5 and the IF amplifier-cum-limiter a 6AU6.

PLATE LOAD?

From what I had heard of the sound when it failed, and on the law of probabilities, I decided to check the 6BM8 triode plate load. Next to the screen resistor in a pentode stage, this item is the most likely suspect when an audio system displays such symptoms.

I started by unhooking one end of the resistor, then switched the set on to compare the effect. But, as soon as it warmed up I realised that the effect was not the same. The drop in volume was much greater in this case, in fact there was very little signal at all.

Of course, I could not overlook the possibility that the resistor was simply "going high" rather than open circuit. In fact, I was toying with the idea of slipping a 10 meg. into place just as a trial, but decided to put the original resistor back in place for the moment.

I commenced this while the set was still running, and found that I had to exert some pressure on the terminal strip in order to put the pigtail back into its original place, preparatory to soldering it.

It was while I was thus engaged that I realised that the sound had dropped appreciably and was commencing to distort. It wasn't nearly as bad as the original trouble, but it was the same kind of symptom. I pressed harder on the terminal strip—quite hard in fact—and the effect became noticeably worse.

SUCCESS

Thus encouraged, I commenced a detailed examination of the terminal strip. And once I was on the track, it didn't take very long. Hidden under a bunch of minor components I came across one of the speaker transformer voice coil leads where it terminated on the strip. It had been pushed through the eyelet hole, given a half twist—and left at that. No soldering iron had ever been near it.

Well, that semed simple enough, and it didn't take long to remedy. However, it came as a bit of a shock when I checked the other voice coil lead alongside it and found that, although it had been soldered, it was a beautiful dry joint. So that, too, had to be repaired.

All of which was something of a letdown after I had prepared myself for a highly organised battle. But that's how it goes with jobs like this, and one naturally doesn't complain when the solution suddenly turns up "on a plate."

I rather imagine that the mechanical rigidity of the voice coil leads had been such as to ensure reasonable contact in most circumstances, but that this was upset when the chassis became sufficiently heated. The time factors involved seem to suggest a heat cycle, and the situation could have been aggravated by the prevailing weather conditions.

Assuming this to be so, it is perhaps just as well that I found the trouble the way I did. Out of the cabinet, the chassis may not have been able to work itself up to a sufficient temperature to produce the fault, leaving it nicely up in the air, and probably taking much longer to track down. Which, in turn, suggests that such faults may be better treated, initially at least, in the cabinet where the temperature is more typical.

It is also noteworthy that it was only sideways pressure on the terminal strip that revealed the fault. The pounding of the chassis I had indulged in earlier and vibration in general had had no effect.

Which just goes to show how stubborn such faults can be.

And while still on TV, here is a short one with an unusual twist. Can the linearity adjustment effect the flicker content of a TV picture? Like myself, you'd probably be tempted to answer "no" to that one, yet I encountered just such a case recently.

The customer mentioned a number of troubles, including the fact that the neighbours "little darlings" apparently had been having happy fun games with the semi-permanent controls (height, width, linearity, etc.) which, on this set, happened to be on the front of the cabinet.

LOCALISED FLICKER

But the fault which really worried him was described as a very bad flicker at the top of the picture. I was rather puzzled by this because (a) flicker is not normally a function of the set anyway, and (b) I couldn't quite make out why it should be confined to the top of the picture. I could only imagine that the ion trap had slipped, making the top of the picture much brighter than the lower half.

Strangely enough, my first impression was not of the flicker at all, but rather of gross vertical non-linearity. The lower half of the picture was badly compressed, and the upper half equally badly stretched. As can be imagined, the effect was pretty horrible.

But the owner was only vaguely conscious of this fault (which I should have imagined would be most objectionable to even the most casual viewer) but continued to complain that the flicker at the top of the screen was most distressing.

I stepped back the normal viewing distance and tried to ignore the horribly elongated bodies running round on compressed legs. Sure enough, I had to admit that portions of the picture did flicker quite obviously, mainly where a horizontal line formed part of the picture.

Once I realised the exact nature of the fault, the cause was immediately evident. And, believe it or not, it was the badly distorted linearity which was causing the flicker. The top of the picture was so badly stretched that the line structure was objectionably evident at the normal viewing distance and the effect known as "inter-frame flicker"—always likely to be present to some degree—was equally obvious.

INTERLACE PROBLEM

Inter-frame flicker is a minor by-product of normal interlace scanning, in which we present 50 fields per second rather than 25 complete pictures in succession. The fact that a field consists of only half the total number of scanning lines is of little consequence for the most part and, as far as flicker is concerned, the eye treats each field much as it would a complete picture.

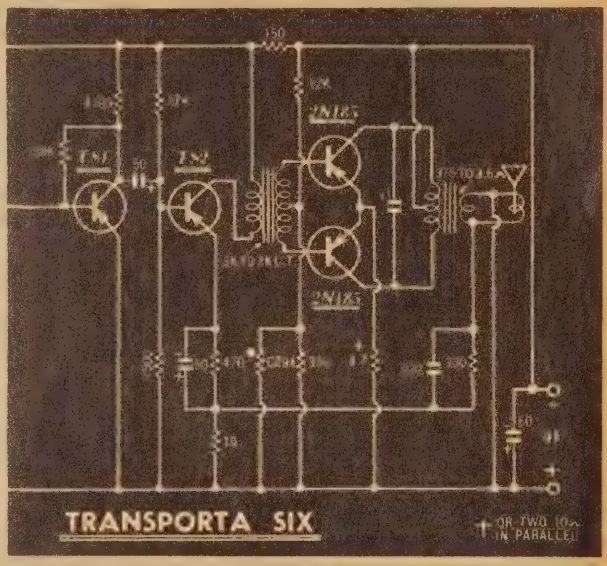
However, there are exceptions, and inter-frame flicker is one of them. This is most likely to occur where we have an obvious horizontal line of demarcation, such as the dark ridge of a house against a light sky. A few moments thought will make it obvious that this horizontal outline, if it is exactly parallel to the scanning line can be scanned only by each alternate field.

Thus this piece of information will be presented only 25 times per second, with an equal blank period between. Of course, this is true of every elemental area on the screen, but an outline as prominent as this becomes comparative-

☆

This circuit, from one of the Transporta series, is typical of transistor output stages. Note the Thermistor (CZ9A) in the bias network, and the 4.7 ohm resistor in the emitter circuit. The latter is to guard against "runaway" due to overdriving.

☆



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INPUTS: Choice of three — (1) Stereo, (2) Monaural, (3) Radio Tuner. For crystal pick-ups only. Built-in compensation for flat playback requires no external RC networks.

OUTPUT RESISTANCE: Approximately 0.5 ohm on 15 ohms termination.

LOUDSPEAKER IMPEDANCES: Choice of three, accommodating (1) 3½ to 4 ohms speakers; (2) 7½ to 8 ohms speakers; and (3) 15 to 16 ohms speakers. Instant selection; no links to arrange.

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VALVES USED: Two type 12AX7 and four type 6BM8 plus two Silicon Diodes type OA210. Each of the six are double valves.

SENSITIVITY: Pick-up — 100 mV for 7 watts output; Radio—50mV for 7 watts output.

FREQUENCY RESPONSE: At 1 watt output within 2 db of 1 kc/s level measures 30 c/s to 60 kc/s; at 7 watts output within 2 db of 1 kc/s level measures 30 c/s to 10 kc/s.

SIZE: Front panel 13½in long; 4¾in wide. Depth not more than 7in. behind panel.

FRONT CONTROLS: From left to right—Selector Switch, Bass Control, Treble Control, Balance, and Volume with Mains ON/OFF Switch. BASS control: at 100 c/s, 11 db lift and 9 db cut.

TREBLE control: at 10 kc/s, 11 db lift and 15 db cut. BALANCE control: equal output from both channels to full cut-off on either channel.

Performance figures verified in the test laboratories of one of Australia's leading valve manufacturers.

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ly obvious, particularly if the viewing distance is such that the line structure is readily apparent.

As I said earlier, this is only a minor by-product, and does not normally distress the average viewer. Undesirable though it might be from a purely technical point of view, it is far better than the extreme overall flicker which would result from a "straight" scanning system.

But in the case under discussion the effect had been grossly exaggerated by the very obvious line structure at the top of the picture, every horizontal or near horizontal outline producing quite pronounced flicker.

So there it is, excessive flicker caused by poor linearity. Simple when you know why, isn't it?

HORIZONTAL HEIGHT?

(Incidentally, and while on the subject of semi-permanent adjustments, I came across a set recently which had one such control clearly marked "vertical height." Thus encouraged, I expected to find one marked "horizontal height," but I searched in vain. And it was a well-known make, too!)

Turning from TV, I have some comments concerning transistor sets. And first off, I would like to deplore the habit—which seems to be growing—of referring to transistor sets simply as "transistors." As I see it is about as sensible as referring to a conventional radio set as "a valve," or the latest acquisition a "a television."

The only bright spot is that the newspapers, who fell into the "transistor" trap early in the piece, seem to have woken up, and now add the word "set" when that is what they mean. On the other hand, it is significant that they continue to quote some of our more prominent citizens as still making the same mistake.

Maybe it's only a small point, or perhaps I'm getting old and cranky, but it does seem that there is enough sloppy speech among the younger generation anyway, without it being encouraged by those who should know better.

Turning to the technical side, I have to report a rather strange succession of transistor failures over the past few weeks; failures for which I can find no satisfactory explanation.

FIRST CASE

The first case occurred a couple of months ago, and I had intended to mention it in last month's article but had to hold it over for lack of space. The set was a local model, seven stage type, and it was completely dead when I received it.

I imagined it would be a simple case of battery failure, the most usual cause of such troubles, particularly when the set has been left running and the battery completely exhausted. But the battery showed normal voltage, even with the set switched on.

An interesting sidelight on the advent of transistor sets is that I find that my faithful old signal tracer is getting much more use than formally. To be quite honest, signal tracers have not enjoyed a great popularity in the past. They seem to have drifted into a kind of Cinderella role, whereby they were pushed into the background and only brought out when there was some particularly difficult job to be done.

Maybe this is because most of us learned to cope with the routine jobs using only a multimeter and keen observation but, whatever the cause, the tracer never seems to have been quite "accepted" along with the more conventional gear. Now, however, when we can no longer prod a grid (or base) connection with our finger, signal tracing looks like a handy method of quickly isolating the faulty stage. It certainly helps to break down the "mystery barrier" the first few times one tackles a transistor set.

So it was that I reached for the audio probe in this case. The detector is usually a good place to start, moving towards the speaker if signals are present there, or towards the aerial if they are not. There were plenty of signals in this detector circuit so I moved towards the output stage.

I was able to follow them, with appropriately decreased sensitivity, as far as the base of each output stage, a pair of 2N185s in this case. At each base, there was plenty of signal, but not a sign of anything at either collector. Either there was a fault in some component common to both transistors, or, strange as it would seem, both transistors had failed together.

NO CURRENT

It didn't take long to establish that neither transistor was drawing any collector current, even when a solid signal was being delivered to them. Nor did there seem to be any reason for this outside the transistors themselves. All bias components were normal, collector voltage normal, etc., but no collector current.

Unsoldering one 2N185, I replaced it with a new one. This immediately brought forth music from the speaker, badly distorted music to be sure, but at least enough to indicate that I was on the right track. Replacing the second 2N185 completed the job, the signals becoming clear as the second half of the system came into operation.

So there it was, two 2N185s had packed up side by side. Whether they had failed at the same time I had no means of knowing, and I seriously doubt whether the owner would have been able to help, even had he wanted to. As far as I could gather, it all sounded the same to him, distortion or no distortion.

But it did seem strange. Even the failure of a single transistor is comparatively rare, and for two to fail together seemed like a very long shot indeed. However, beyond making a note to mention it in my next article, I more or less passed it off as a coincidence and thought no more about it.

TWO MORE

However, since then I have had two more almost identical cases. One was a six-stage set made by the same firm as before, and also using 2N185s. The other was an imported model, apparently of European origin, which used a pair of OC72s, these being of English manufacture.

At the moment I am not quite sure whether there is any significance in this sequence or not. It could be mere coincidence that three such rare faults should all finish up on the same workbench though, frankly, I feel that it is flogging coincidence a bit hard.

On the other hand, I have contacted several transistor manufacturers without being able to find any logical reason for

(Continued on Page 93)

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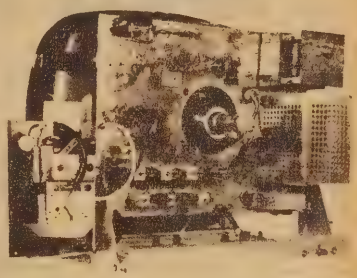

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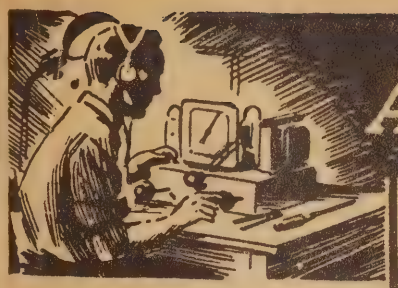
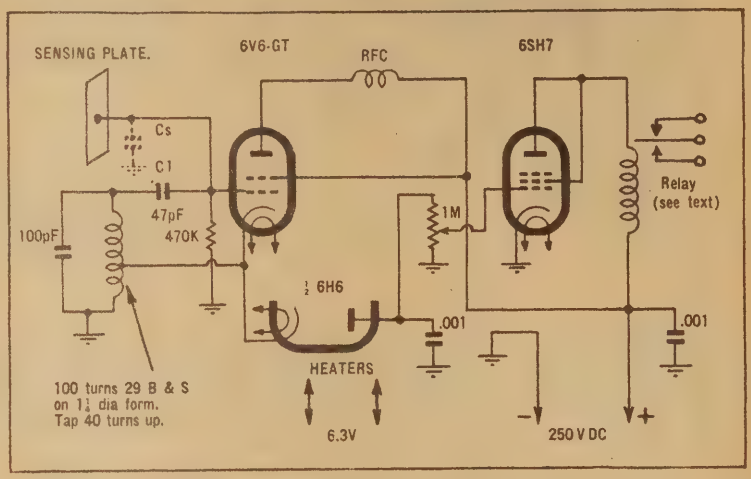


A READER BUILT IT!

Gadgets and circuits which we have not actually tried out, but published for the general interest of beginners and experimenters.

A MAINS-OPERATED PROXIMITY RELAY UNIT

From Mr Noel Bignell, of 15 Scarborough Street, Scarness, Q'land, we recently received this circuit for a mains operated proximity relay. He points out that the circuit is quite simple, yet is sensitive for a foot or more. Here is Mr Bignell's discussion of the circuit:—



"The 6V6 is connected as a Hartley oscillator with a cathode tap high up the coil. The feedback voltage on the 6V6 grid depends on the ratio between C1 and Cs (the stray capacitance between the sensing screen and earth). If Cs is too large the voltage on the grid is insufficient to sustain oscillation.

"The 'critical' value of Cs can be varied by adjusting C1; at this stage a small increase in Cs (such as an approaching hand) will be sufficient to send the 6V6 out of oscillation.

"The rest of the circuit consists of a diode which rectifies some of the RF present at the 6V6 cathode to give a high negative voltage, which is applied to the 6SH7 grid, taking it beyond cut-off. This is the state when the 6V6 is oscillating; when it stops, the RF on the cathode disappears and hence the high negative voltage is no longer applied to the 6SH7 grid.

MANY USES —

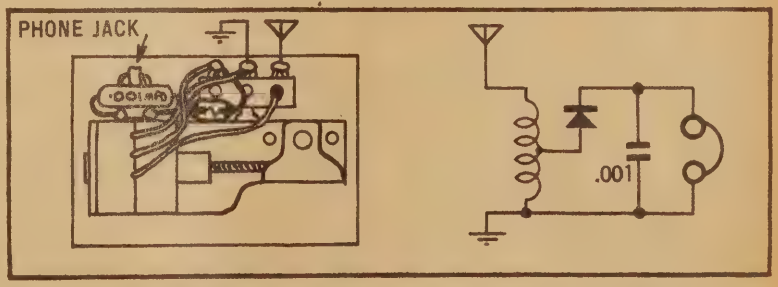
"Thus, if the 6V6 stops oscillating, the 6SH7 is able to conduct and the relay in its plate circuit closes. The relay contacts may be made to switch various devices such as bells, lights, etc. I once saw a device of this nature at the local show, operating a piece of farm machinery when anyone approached.

"To adjust the circuit, advance the pot. fully; rotate C1 until the relay drops in, then back again until it just drops out. The pot. may then be backed off until the relay drops in and then advanced until it drops out.

"The relay should be one that closes with about 15 mA. through the coil (or less). If larger valves, such as the 6V6, are used in place of the 6SH7, larger and less sensitive relays could be used."

Mr Bignall does not give details of the sensing plate, but it is suggested that this might be an aluminium disc about 4 inches in diameter, cemented to the rear centre of a sheet of plate glass about 18 inches square. A countersunk screw can be used to fasten a solder lug to the disc for connection to the circuit, and the disc can be cemented to the glass with one of the newer contact adhesives.

SLUG-TUNED CRYSTAL SET



Mr. David Rogerson of 8 Pisgah St., Wendouree, Ballarat, Vic. sends us this circuit and drawing of a crystal set which he built into a matchbox. The set was made around one of the new slug-tuned coil units, and was fitted with a hearing-aid type crystal earpiece.

As the drawing shows, the components are supported by the miniature phone jack and a 3-lug tagstrip (which has the foot bent practically flat to conserve space). The diode and 0.001 uF capacitor are supported on these units, the coil unit being screwed directly to the box.

Apparently it does not matter which end of the coil goes to the earth or aerial, as long as the middle lead, which is the centre tap, goes to the diode. For aerial and earth terminals Mr Rogerson used two paper clips soldered to the ends of four-inch lengths of insulated wire.

Considering its small size and simplicity, Mr Rogerson claims the set works surprisingly well. With just an aerial, it was possible to receive all the local stations in the district around the contributor's home. Incidentally, the diode used may be a general purpose type or a video detector type if one is handy.

Housed in this contemporary cabinet, our new set makes an attractive addition to any room in the house. It is completely self contained and a first-class performer.

A High Performance 8 Transistor Radio

The recent release of drift transistors for RF amplifier service, and at a reasonable price, has allowed us to present this completely new eight-transistor receiver. Featuring an RF stage, it is eminently suitable for the country listener, and may well replace that "tired" old conventional battery set.

By John Barker

Prior to describing this receiver, our most ambitious transistor projects were the very popular Transporta Six and Seven.

These were portables in the true sense of the word. Every effort was made to keep excess weight to a minimum and the battery consumption as low as possible, without sacrificing too much in the way of output power.

DIFFERENT NEED

With our present design we are seeking to satisfy a somewhat different need and one which, locally, has not been catered for to any extent.

In short, it is the need for a battery-operated domestic-type receiver for use in areas not served by the AC power mains.

As distinct from the average portable, it needs to be styled for the domestic scene; it should have ample acoustic output, good gain and signal/noise ratio and, for remote areas at least, be capable of making best use of a large outside aerial and earth.

Not being designed primarily as a portable, such a receiver can well use larger batteries to secure longer battery life relative to replacement cost.

By simply substituting a ferrite rod aerial for the aerial coil, the same type of receiver could well have an attraction, even in areas served by AC mains, because it would be completely self-contained.

The advantage of a self-contained receiver becomes apparent when one is required by a sick bed or, perhaps, on a veranda or in some area of the home lacking a power point. It is a very tedious business trailing a flex from room to room, as is often necessary with a mains-powered set.

Overseas, so-called "cordless" receivers are being advertised commercially, as distinct from the differently styled "portables."

An important point is that the cost of operating a modern transistor receiver compares very favourably with the cost of running a mains-powered set of comparable size. The few shillings is spent on an occasional battery, instead of appearing on the quarterly power account.

In making these points, it is not intended for one moment to discount the place which the normal portable receiver has in the scheme of things.

But, as a rule, the average portable owner is not unduly worried about quality of reproduction. He is much more concerned about the weight and bulk of the set—even if it does involve fairly frequent replacement of small batteries.

SPEAKER SIZE

The matter of speaker size is generally a compromise between overall set size and the minimum speaker efficiency tolerable. With the "Transporta" receivers a five-inch speaker was considered adequate and, considering the limitations, they performed remarkably well.

With our present set, in the cabinet which we have suggested, we use a 5in x 7in elliptical speaker. This can have better overall performance than the smaller 5in type, and the general improvement in audio quality is really worthwhile.

Of course, the 5in x 7in speaker is by no means a limit and a bigger speaker in a suitably designed cabinet can only result in further improvement. It is really up to the individual constructor.

For the audio section of the receiver we decided to use the printed audio circuit board, which had proved so successful in previous transistor equipment.

The main advantage with this board is that the labour involved in wiring the audio section is cut to a minimum. Also it is readily available and the layout has proved to be most satisfactory.

However, use of the board is not absolutely necessary and the whole section may be wired under the chassis in the normal way.

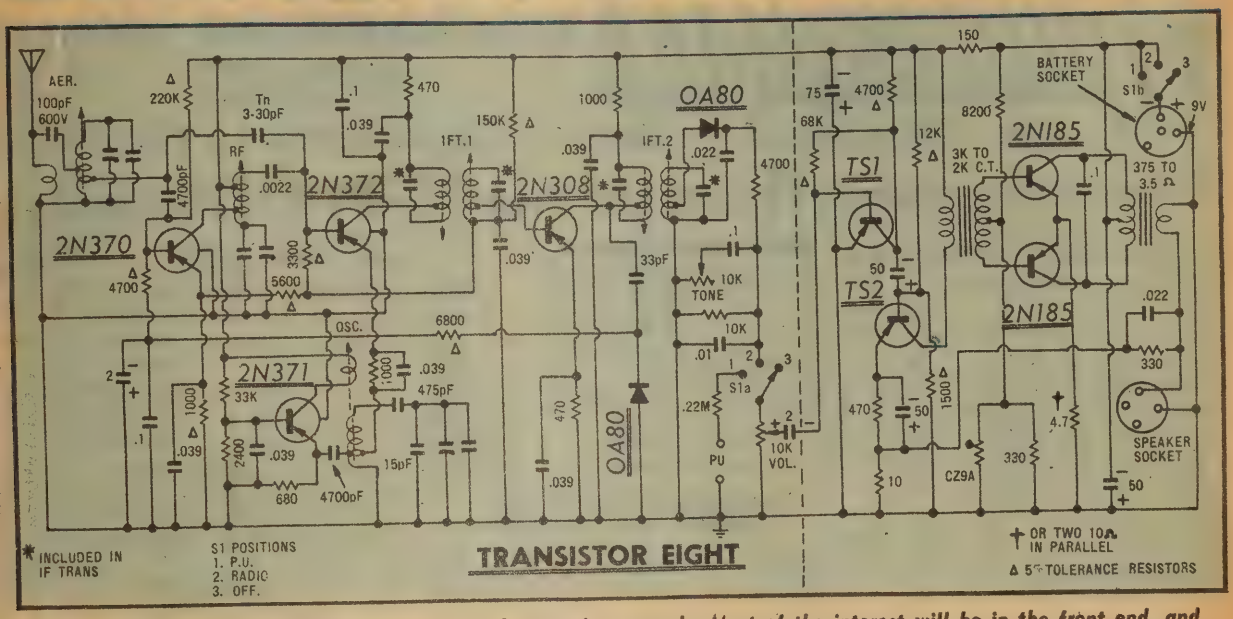
ADEQUATE OUTPUT

The present audio board uses a pair of 2N185s, or their equivalent, in push-pull, class-B. With a nine-volt battery, they will produce an output of about 300 milliwatts. For normal room listening and with the speaker we have suggested, this is more than adequate output.

The RF section of the receiver will drive the audio stage to full output with a signal of about 10 microvolts in the aerial. This should be ample for most purposes, though a little down on the best valve-type battery superhets.

We have included pick-up terminals and quite acceptable reproduction may be obtained, when using one of the battery-powered turntables currently available.

CIRCUIT USES RF STAGE FOR HIGH PERFORMANCE



The circuit follows established practice for the transistors used. Most of the interest will be in the front end, and the use of drift transistors with possible short-wave operation in mind. The audio section is the same as used for the Transporta series.

There is the possibility, of course, of replacing the output transistors with higher power types. The extra output thus obtainable would benefit mostly the record-playing facility, but the extra battery drain may be of consequence. We are at the moment investigating this problem.

Another departure from previous practice has been the addition of an RF stage.

When it was decided to improve the sensitivity of the original "Transporta Six," which had only a converter and one IF stage, we considered the possibility of adding an RF or an extra IF stage.

Since transistors suitable for use in RF service were, at the time, expensive and not freely available, it was decided that an IF stage would, of necessity, be the choice.

In any case, use of an RF stage would have involved provision of a 3-gang tuning capacitor with attendant space problems.

SPACE NO PROBLEM

In the present instance space is not a problem and transistors for RF amplifier service are readily available. It has, therefore, been possible to reconsider use of an RF amplifier stage, giving somewhat lower gain than an IF amplifier but a much improved signal/noise ratio.

The lowest level signal which may be resolved in a received depends, in the ultimate, on the noise level generated in the first stage. Mixers and converters are inherently noisy, RF stages much less so.

Also the extra tuned circuit provided by the RF stage increases the selectivity of the front end considerably, thereby reducing the hazard of stray heterodyne whistles.

One of the problems facing circuit designers who wish to use transistors in RF stages, is that of internal feedback within the transistor itself. Normally the transistor has a relatively large collector-to-base capacitance and, at higher frequencies, energy is fed back to the input from the collector, and oscillation can result.

This is exactly the same as the trouble experienced when triode valves are used in similar fashion.

The effect may be offset by neutralising, which is a process of feeding back to the input an out-of-phase voltage in such a way as to cancel the oscillation. However, neutralisation is usually only completely successful over a limited range of frequency.

An RF amplifier in a typical broadcast receiver must operate over a 3-to-1 frequency range and adequate neutralisation over the whole band is very difficult to arrange.

The drift transistor offers a partial solution to the problem. During manufacture of these transistors, the conductivity of the base region is graded in such a manner that the effective collector-base

PARTS LIST

1 Chassis 9in wide x 7½in deep x 2in high.
1 Ferrite rod aerial (if reqd.)
1 Set coils and IF's.
1 Output transformer, 375 ohm C.T. to 3.5 ohms.
1 Driver transformer, 3000 ohms to 2000 ohms C.T.
1 Three-gang tuning capacitor, 415 pf.
2 10k carbon pots.
1 Printed circuit audio board.
1 3 pos., 2 pole switch.
3 3 to 30 pf trimmers (air or mica).
1 3 to 30 air trimmer (Tn).
1 Dial assembly USL/37 or similar.
2 Germanium diodes, GEX35, OA80, GD4, etc.
1 Nine volt battery, 3765 or equiv. to suit cabinet size.
1 Four-pin min. socket and plug for battery.
1 Four-pin min. plug and socket for speaker (different from battery plug).
4 Knobs.
1 5 x 7 elliptical speaker, or other to suit indiv.

TRANSISTORS: 1-2N370, 1-2N371, 1-2N372, 1-2N308, 1-TS1, 1-TS2, 2-2N185.

RESISTORS

All ½ watt: 5%; 2-4.7k, 1-1k, 1-220k, 1-5.6k, 1-6.8k, 1-68k 1-12k, 1-1.5k, 1-150k, 1-3.3k, 10%; 1-4.7k, 2-1k, 1-2.4k, 1-3.3k, 1-82k, 1-10k, 1-47k, 1-680ohm, 3-470ohm, 2-10ohm, 2-330ohm, 1-4.7ohm (or two 10 ohm in parallel), 1-33k.

CAPACITORS:

MICA: 1-475pf 2%. 1-100pf 600v, 4-100pf 1-15pf, 1-33pf.
CERAMIC: 2-4700pf.
PAPER: 7-0.039uf 200v, 1-0.0022uf 200v, 2-0.022 uf 200v, 1-0.01uf 200v, 4-0.1uf 100v.
ELECTROLYTICS: (All 12v) 2-2uf, 1-75uf, 3-50uf.

THERMISTER: Type CZ9A.
SUNDRIES: Hookup wire, spaghetti tubing, resin cored solder.
TAG-STRIPS: 3-8 tag, 2-2 tag, 1-3 tag, 1-6 tag, 1-7 tag, 1/8 nuts, bots, etc.

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8K	£2 12 6	8M	£3 14 0
8MX	£4 10 6	9-6H	£3 0 6
9-6L	£3 10 0	10-3G	£2 14 6
12K	£3 6 0	12M	£4 16 6
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120		12UX	£24 5 0
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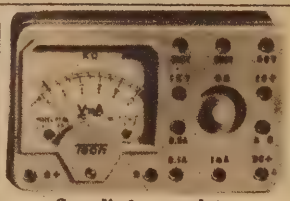

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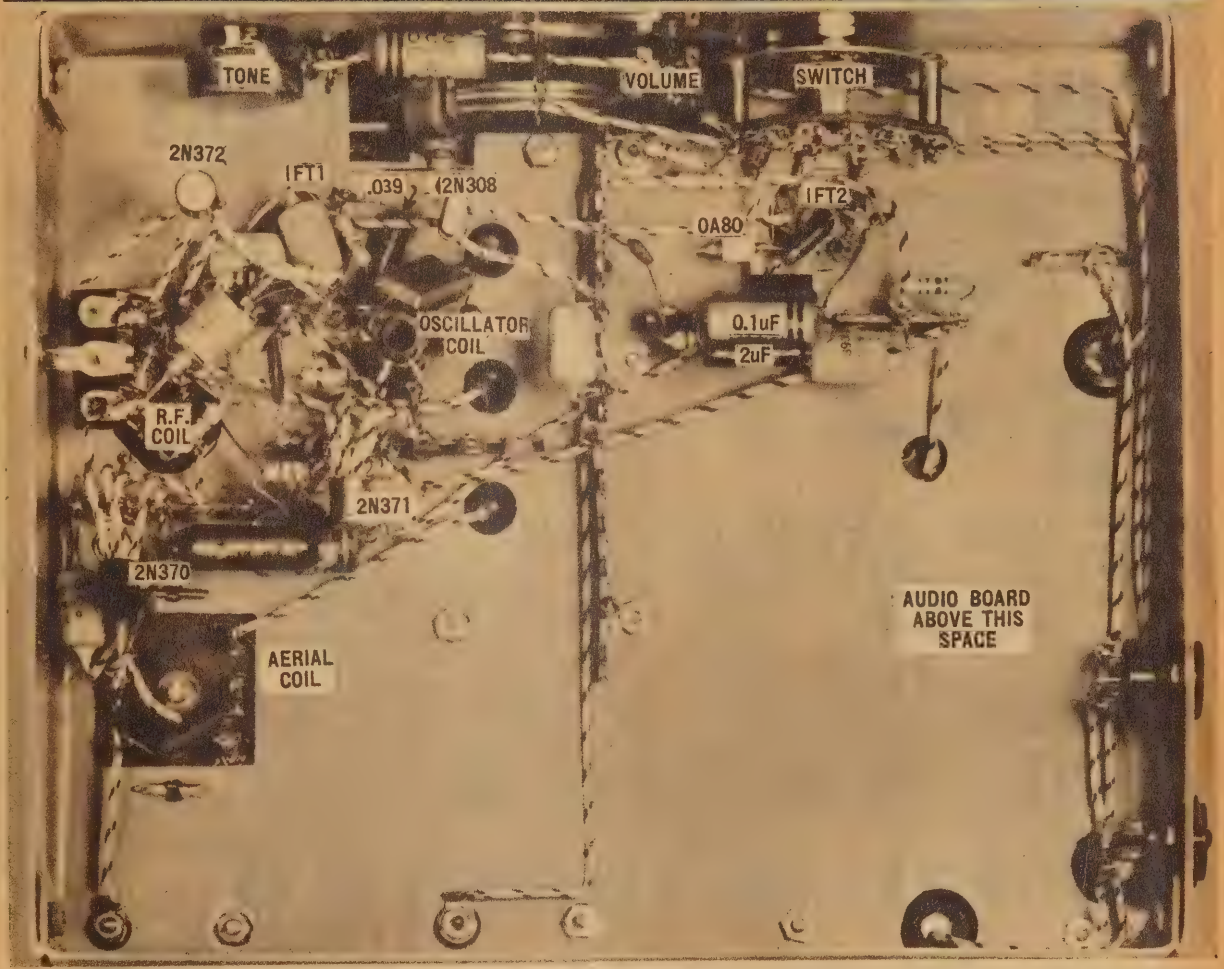


The under chassis view. The orientation of the coils and some other components is discussed in the text. Note that the neutralisng capacitor needs to be a good quality air trimmer to avoid drift. The audio board is above the chassis to the right.

capacitance is reduced considerably.

Further protection is provided by an internal shield between the collector and base. This is the fourth lead from the transistor and is normally earthed.

Sometimes these transistors still need to be neutralised, but it is very much easier because the initial capacitance is itself much lower.

In its final form the RF and IF section of the receiver uses coils produced by Messrs Telecomponents Ltd. of Brookvale, N.S.W., and transistors from the Amalgamated Wireless Valve Co. Pty. Ltd. The circuit is derived from recommendations of these same companies.

It is not normally our policy to be so specific about brands, but the simple fact of the matter is that neither transistors nor the coils to go with them are sufficiently interchangeable to leave the combination to readers' imagination.

However, while a coil kit from Telecomponents Ltd. should be available immediately through trade houses, it is likely that other manufacturers will release special kits for the receiver in due course.

The 2N308 and the audio board transistors are STC types, though replacement with comparable or equivalent types is possible.

If the set is to be used in fairly good signal areas it will be possible to use a ferrite rod aerial instead of the aerial coil and external aerial. This will certainly add to the convenience of the set, particularly if some provision is made for connecting an external aerial and earth as required.

So much then for the general background to our new receiver. Before discussing the construction in detail we will briefly run through the major points in the circuit.

IMPEDANCE MATCHING

The input and output circuits of transistors operate at low impedances so, in each case, the base and collector is connected to a low impedance point in the respective tuned circuit. This matching is to ensure maximum energy transfer.

The RF transistor is drift type, 2N370. It is neutralised by the trimmer Tn, connected between its base and the input of the next stage. The adjustment of this trimmer is discussed later on.

The mixer is a type 2N372. The signal from the RF stage is fed to its base and the output of the oscillator is fed into the emitter. The output of this stage contains, among other things, the intermediate frequency, 455Kc.

The oscillator is the 2N371. Output from this stage appears across the bottom section of the tuning coil and should be about 0.4 to 0.5 volts peak to peak. This is effectively in series with the mixer input.

The IF stage operates at 455 Kc and the output is fed to the diode detector. A second diode supplies the AVC voltage to control the gain of the RF end of the set.

Efficient AVC is more difficult to arrange with transistor circuitry than with valves. Transistor bases draw current, unlike valve grids, so that the AVC circuit must supply power to control gain.

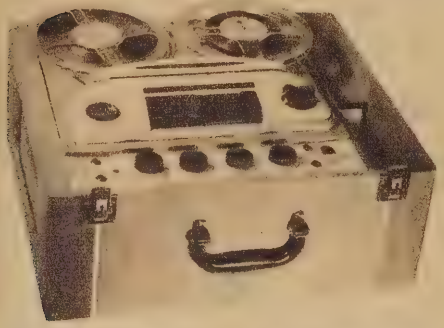
In this case the output of the AVC diode is fed initially to the RF stage base and thus varies its gain in such a manner that this stage cannot be overloaded even in the presence of a strong signal.

At the emitter of this stage an amplified version of the AVC signal appears and AVC current is taken from that point to the mixer and IF stages. The resultant AVC characteristic for the receiver as a whole is excellent.

(Continued on Page 63)

NEW *Releases!*

IN HI-FI TAPE RECORDERS



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- **High Fidelity. Frequency response 40 to 12,000 cycles at 7½in per second.**
- **Three 4-pole shielded motors.**
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- **Two track.**
- **Light piano key controls.**
- **PAUSE CONTROL**
  This has the effect of stopping the transit of the tape past the "Record/Playback" and "Erase" heads and applying the brakes to the spools while leaving all switches and mechanical functions in their selected positions. Typical application is to pause whilst recording to omit speech interposed between musical selections. Control will only work whilst it is held in position.
- **TAPE MEASURE AND CALIBRATING DEVICE**
  The three digit counter makes the location of any recorded passage the simplest of operations.
- **TRANSCRIPTION TECHNIQUE**
  A large diameter flywheel with ground and lapped steel shaft running on a ball at the bottom of long bearing reduces friction and virtually eliminates "wow" and flutter at less than 0.15 per cent at 7½in per second.

COMPLETE RECORDER WITH MIKE 69 GNS. f.o.r.

A NEW POPULAR PRICED RECORDER AT 49 gns. f.o.r.

MODEL TR3. For this recorder we have chosen the new English B.S.R. deck. This is a two track single speed unit (3¾in per second) giving two hours' playing on a 5¾in long play tape or one hour on a standard 5in tape.

Automatic locking device prevents accidental erasure. Frequency response 60 to 8,000 cycles.

The five valve amplifier including "magic eye" level indicator has two inputs, for microphone, radio, or pick-up; and outputs for external amplifier or speaker, equalised to C.C.R. standards. Can be used as straight amplifier if required. Output 3 watts.

The recorder is fitted in attractive two-tone case with dual speakers and microphone.

Overall dimensions 14in x 10in x 6½in. Weight 26lb.

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10 VALVE DUAL WAVE HIGH FIDELITY RADIOGRAM CHASSIS WITH R.F. STAGE. INCORPORATING THE MULLARD 5-10 AMPLIFIER AND TONE CONTROL CIRCUIT (SEPARATE BASS & TREBLE CONTROLS) AND SUPPLIED WITH THE NEW ROLA 12PX SPEAKER. **£38/10- F.O.R.**

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Two pair of M.S.P. Jensen speakers or two Rola 12in dual coned speakers supplied. Power output 10 watts per channel (20 watts). Frequency response of amplifier 40 to 15,000 cycles.

THIS UNIT CAN NOW BE SUPPLIED WITH THE NEW ROLA 12 PX SPEAKERS

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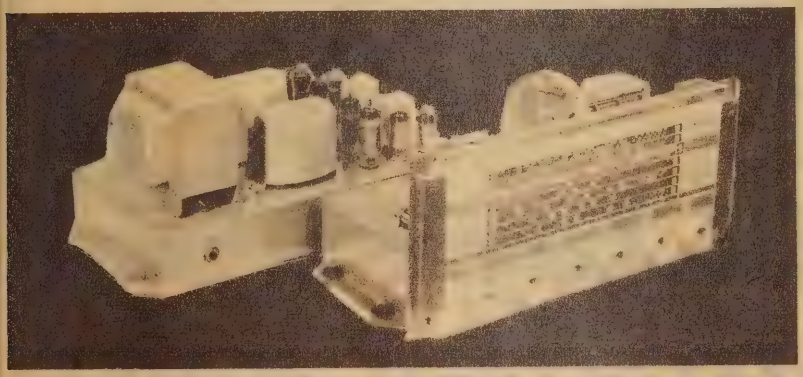
Complete stereo unit comprising dual wave tuner with tuned R.F. stage, multi-input two channel pre-amplifier with tone controls and two Mullard 3-3 amplifiers, power supply on separate chassis. Supplied with two Rola 8MX speakers. Power output 4 watts per channel. Frequency response of amplifier 40 to 15,000 cycles. **£49/15/-** F.O.R.

8 VALVE HI-FI STEREOGRAM CHASSIS

Complete tuner and amplifier for stereo incorporating the "Mullard 2-2" amplifier circuit with separate bass and treble controls. Output 3 watts per channel. Supplied with two Rola 8MX speakers. Frequency response 50 to 10,000 cycles. **£41/15/-** F.O.R.



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Tone control and audio stages incorporating the Mullard 5/10 amplifier circuit with separate bass and treble controls giving plus or minus 15 db boost or cut at 50 cycles L.F. and 10,000 H.F., combined with push-pull output with inverse feed-back gives you really high fidelity reproduction from your radio or favourite recordings.

NEW:

Dual speaker combination using the new Jensen M.S.P. 12PR woofer with matched tweeter and cross-over network giving a frequency response of 40 to 12,000 cycles. If required the Rola 12MX speakers can be supplied (with the 8 valve stereo chassis, two Rola 8MX speakers are supplied). A.W.A. output transformers used on all units.

NEW:

Six position selector switch is incorporated in all chassis with compensation for L.P. recordings and provision for stereo F.M., or TV tuners and tape recorder.

NEW:

Large calibrated edge-lit dial in perspex (11in x 6in) with main stations of each State in prominent type. Dial fitted with counterweight drive, giving smooth tuning. Dial can be supplied in cream or black with matching knobs and escutcheon to suit contemporary blond or walnut finished cabinets.

NEW:

Sensitive "magic eye" tuning indicator (EM80) making tuning simple and positive even on interstate, overseas and country stations.
All chassis are wired for the fitting of F.M. tuner or tape recorder, special plug being provided on back of chassis, also pick-up terminals and outlet for gramo. motor.
Power switch is fitted to volume control. Audio end of set can be used with TV receiver if required.

COMPLETE RANGE OF DUAL, COLLARO, B.S.R. AND GARRARD, STEREO PLAYING EQUIPMENT IN STOCK

Classic Radio

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ACOS REPLACEMENT CRYSTAL CARTRIDGES

GP37-1C
Standard replacement crystal turnover Cartridge for most record changers. Now replaced by GP65-1G.
PRICE:
Twin Sapphire Styli, £2/18/6.
Sapphire/diamond Styli, £4/19/6.

GP65-1G
Crystal turnover Cartridge, standard ½" mounting bracket. Improved GP37 performance.
PRICE:
Twin Sapphire Styli, £2/18/6.
Sapphire/diamond Styli, £4/19/6.

GP67-3G
High gain turnover crystal Cartridge, suitable for reproducing standard and micro-groove recordings with low gain amplifier.
PRICE: Twin Sapphire Styli, £2/3/-.
Sapphire/diamond Styli, £4/4/.

GP61
Turnover ceramic Cartridge. Unaffected by heat or humidity. Specially designed for tropical areas.
PRICE:
Twin Sapphire Styli, £2/18/6.
Sapphire/diamond Styli, £4/19/6.

HGP39
Crystal Cartridge. Available for standard or L.P. recordings for use with HGP20 and HGP40 Pick-up Arms.
PRICE:
Single Sapphire Stylus, £3/12/6.
Single Diamond Stylus, £5/13/6.

ACOS STEREOPHONIC CARTRIDGES

AUSTRALIAN AGENTS.

GP73 Series
Turnover stereophonic Cartridge, plays all types of recordings. GP73-2 Medium output. GP73-5 High output. Available with standard ½" mounting bracket (type A), or special mounting bracket for end mounting (type B).
PRICE: Twin Sapphire styli, £3/6/-. Sapphire/diamond stylus, £7/13/6.

GP71 Series
Cartridge plays stereo and L.P. recordings, non-turnover type.
PRICES: GP71 with sapphire stylus, £3/6/-.
GP71 with diamond Styli, £5/16/6.

AMPLION (A/SIA) PTY. LTD. 101 Pyrmont Bridge Road, Camperdown, SYDNEY, N.S.W.

the right replacement stylus!

Individually packed, complete with nylon cleaning brush for extra care of records.

METRO-SOUND

MASTER POINT . . . SAPPHIRE and DIAMOND

For faithful reproduction . . . for longer playing hours and greater protection of cherished discs, use the new Metro-Sound Sapphire and Diamond Master Point Styli. There's a complete range to fit all pickups and cartridges . . . for stereo as well as monaural discs.

You can buy Metro-Sound Master Point from leading record suppliers.

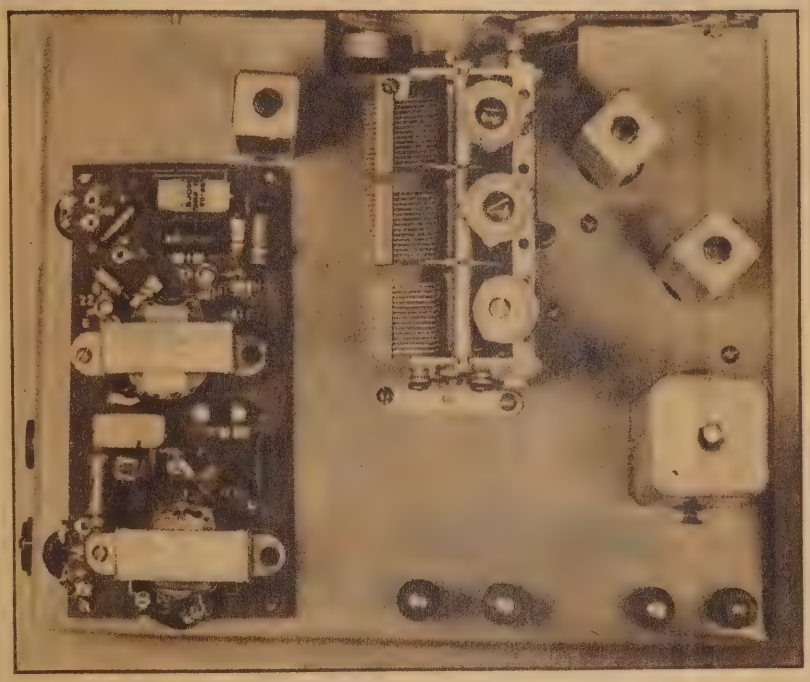
Sole Australian Agents:

LEO ROGALY AND LEWIS PTY. LIMITED

35 Bathurst Street, Sydney. Phone 61-6607

VICTORIA: R. Feldmann, 163 Swanston St., Melbourne
QUEENSLAND: T. A. Ferry, 77 Queen Street, Brisbane.
WEST. AUSTRALIA: D. B. Sharp, St. George's Terrace, Perth.

THE CHASSIS LAYOUT—TOP VIEW



The large can at lower right is the aerial coil, with the RF coil above it and the 1st IF transformer alongside the gang. The 2nd IF is to the left of the gang. The oscillator section of the gang is nearest the dial.

(Continued from Page 59)

The audio stages are quite conventional and little need be said about them. A "top-cut filter" type of tone control is provided and simply attenuates some of the higher frequencies.

In regard to the construction of the set, we suggest that you follow our layout which we know is satisfactory.

If we study the under-chassis view (page 59) we will see the following layout.

AERIAL CIRCUIT

The aerial terminal is in the bottom left corner, and above it is the aerial coil. The base of this coil is marked with a green spot which identifies the pin connecting to the gang. This pin is in the top right-hand corner of the coil cut out.

Immediately above the aerial coil is an eight terminal tag strip upon which is mounted the RF transistor (2N370). All the "earthy" ends of the RF components are returned to the left-hand earth terminal. The 0.1 uF by-pass capacitor in the battery negative line is also earthed here.

Above this strip, on the side of the chassis, is a three-terminal strip which supports the neutralising capacitor.

Underneath the trimmer is the RF coil, oriented so that pin number six is to the right. This is the connection to the battery negative line.

Another eight-terminal strip above this coil is used to support the 2N372 mixer transistor and some of the IF components. Just above this strip is the first IF transformer which is orientated so that pin number 1 is to the extreme right. The earths for the mixer and the IF coil are taken to the right-hand earth terminal.

To the right of the RF coil is the oscillator coil (unshielded and mounted beneath the chassis) and the tag strip supporting the 2N371 oscillator transistor. The strip is a six terminal type and all the oscillator section earths are taken to its earthy terminal.

The IF transistor is straddled between the first IF transformer and the eight-terminal strip at the top centre of the picture. The strip below this in the very middle of the chassis is not required. It was not taken out in time for the photograph.

The second IF transformer is at the top right below the switch. It is mounted with pins 3 and 4 to the left. The seven-terminal strip below this coil supports the diodes and the audio and AVC filter components.

TONE CONTROL

The tone control is to the extreme left. The capacitor to its right is the 0.1 uF and goes to the "top" of the volume control. At the bottom right-hand side of the chassis are the two sockets for the battery and the speaker. They need to have different pin configurations to preclude the possibility of plugging the speaker into the battery socket and vice versa. The two types, with the pin configurations shown in the diagram, are readily available.

As will be seen from the photographs, the transistor leads have all been left long. There is no real need to cut them short. We have not experienced any instability troubles with them as they are. The usual care should be exercised when soldering transistor leads to avoid damage due to excessive heat.

(Continued on Page 103)

Another Shipment Available Soon of GELOSO

RECEIVER FRONT-END

FOR AMATEUR BANDS

This is the front-end of the Geloso G209-R Communications Receiver. Supplied complete with dial and matching tuning condenser, trimmer condensers and first i.f. transformer at 4.6 Mc., permitting immediate use as converter feeding any receiver capable of tuning to 4.6 Mc.

FREQUENCY RANGES:

10-Metre Band (28.0 - 30.0 Mc.)
11-Metre Band (26.0 - 28.0 Mc.)
15-Metre Band (21.0 - 21.5 Mc.)
20-Metre Band (14.0 - 14.4 Mc.)
40-Metre Band (7.0 - 7.3 Mc.)
80-Metre Band (3.5 - 4.0 Mc.)

Dial drive with 46 :1 step-down ratio. Complete circuit diagram of G209-R Receiver supplied with each unit.

£24'10'0 plus 25 p.c. Sales Tax

Valves not supplied: 6BA6 r.f. stage, 12AU6 oscillator-buffer, 6BE6 mixer.

TECH

VACUUM TUBE VOLTMETER

Model PV-58

Designed to read DC, AC, Zero-Centre, RF and HV.

AC-DC Voltage ranges: 0-1.5, 5, 15, 50, 150, 500 and 1,500 volts.

Type HV-20 High Voltage Probe with inbuilt multipliers extends DC scale by a factor of 20, giving full scale readings of 0.30, 100, 300, 1,000, 3000, 10,000 and 30,000 volts. Decibel scale available for level observations based on 1mW. into a 600 ohm line as zero db. corresponding to 0.774 volts AC on the 1.5 volt range. An AC volts/db. conversion chart supplied with each instrument as part of instruction booklet.

TECH Model PV-58 V.T.V.M.

£19'10'0 plus 12½ p.c. Sales Tax

Accessories:

RF-22 HIGH FREQUENCY PROBE
46/6 plus 12½ p.c. Sales Tax

HV-20 HIGH VOLTAGE PROBE
63/ plus 12½ p.c. Sales Tax

TMK Model MG-310 MULTITESTER

Sensitivity 20,000 ohm/V.DC
10,000 ohm/V. AC

Ranges:

0-5, 25, 100, 500, 1,000 volts AC.
0-5, 25, 100, 500, 1,000, 5,000 volts AC.
DC Current: 0-1 microamp.; 0-5, 50, 500 mA.
Resistance: 0-60K, 600K, 0-6Mg., 60Mg. ohms.
Decibels: Minus 20 to plus 16 db., plus 30 db.

£8/5/0 plus 12½ p.c. Sales Tax

TECH POCKET VOLT-OHM METER, Model PT-34

Sensitivity 1,000 ohm/V. using 300 microamp. meter.
Ranges:
0-10, 50, 250, 500 and 1,000 volts AC/DC.
0-1 mA., 100 mA and 500 mA.
0-100K and Infinity ohms.

44/- plus 12½ p.c. Sales Tax

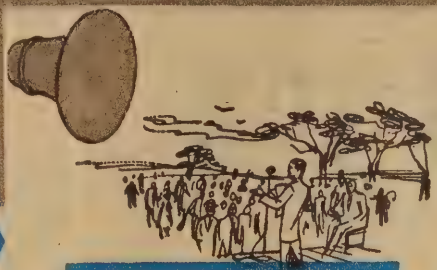
The House of Quality Products

WILLIAM WILLIS

& CO. PTY. LTD.

428 Bourke St., Melbourne, C1.
Phone MU2426

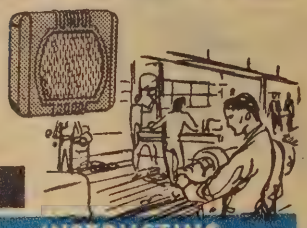
FOREMOST IN SOUND . . .



COMMUNICATION

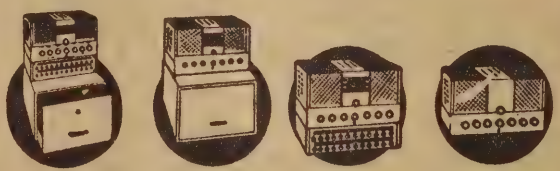
ENTERTAINING

PAGING



INSTRUCTING

There is a planned AWA Sound Reproduction System for every need in the commercial, industrial, educational, cultural and entertainment activities in the community. The range of AWA Audio Amplifiers, Microphones and Speakers provide a type for every purpose, with features and facilities to meet every need in sound amplifying and distribution.



ADDRESS, RADIO AND RECORD PLAYING SYSTEMS

Manufactured and Guaranteed by

AMALGAMATED WIRELESS (AUSTRALASIA) LIMITED

554 Parramatta Road, ASHFIELD, UA0791 • 167 Queen Street, MELBOURNE MU9161
• Cnr. William and Newcastle Sts., PERTH, 28-3426.

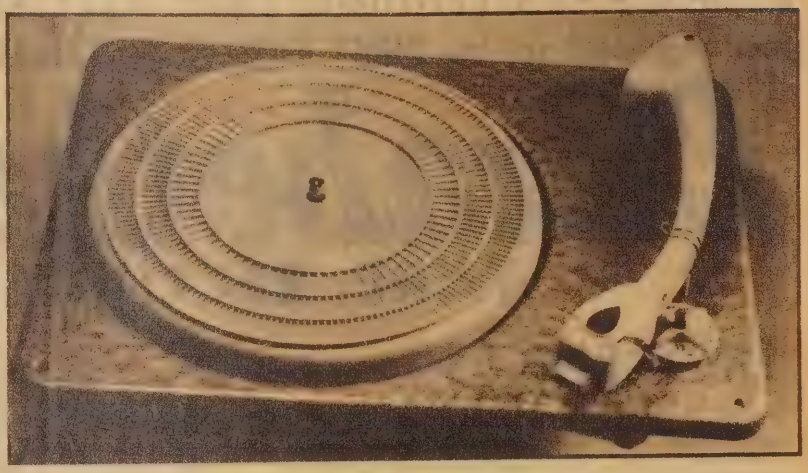
Available in other States from:—

NEWTON McLAREN LTD., ADELAIDE • CHANDLERS PTY. LTD., BRISBANE • and leading wholesalers.

TRADE REVIEWS AND RELEASES

STEREO PLAYER INCORPORATES BELT DRIVE

A new stereo gramophone playing deck being marketed by G.R.D. Instruments Pty. Ltd., promises an excellent standard of performance for a modest purchase price. Manufactured as type 574V by Skandinavisk Radio & Television, of Copenhagen, the unit is to be sold in Australia under the brand name "Labcraft".



TURNTABLE and pickup are assembled on a pressed-table, finished in gold hammertone. Contrray to usual practice, however, the turntable is belt-driven, the drive-motor and four-speed change mechanism being freely suspended as a unit.

The turntable is of eight-inch diameter, running in bronze and nylon bearings, and carries a mat into which is moulded a stroboscope for 78, 45 and 33 r.p.m.

Speeds are selected by rotating a suitably marked knob but an independent spindle through the centre of the knob provides an additional vernier adjustment at all four major speeds.

The manufacturers claim that performance of the deck in respect to wow, rumble and flutter is equal to much higher-priced professional units. While we did not have the opportunity to test this claim in detail, a previously unopened sample motor, submitted to us for test, did in fact perform extremely well at all speeds, with no audible aberrations.

As normally supplied, the unit has the latest Ronette turnover crystal cartridge, available with either a sapphire or diamond stylus for the LP/stereo function. Nominal stylus radius is 0.75 mil.

On test, performance of the cartridge (Ronette type 105) is very similar to that of other high-quality crystal units.

Quality of the motor and arm would appear to justify fitting a magnetic cartridge for special requirements and the distributors are currently examining the question of suitable types. Fortunately the arm has inbuilt provision for varying and adjusting the tracking weight. There is also an inbuilt autostop which appears to operate reliably without reaction on the stylus.

Supplies of the unit are currently limited but they should become freely available through trade houses during the next few weeks. The retail price, including tax, and complete with Ronette stereo cartridge is quoted as £22/6/ (G.R.D. Instruments Pty. Ltd., 6 Railway Walk, Camberwell, Victoria).

DECADE NUMERICAL INDICATOR

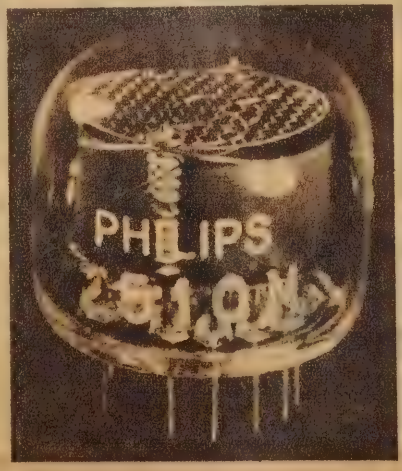
An extremely interesting electron tube has just been released by the Electron Tube Division of Philips Electrical Industries Pty. Ltd. It is the Z510M, a decade numerical indicator tube of all-glass construction and miniature 13-pin base.

ESSENTIALLY a cold-cathode glow tube with ten figure-shaped cathodes, the tube is an ideal read-out device for the many types of counter and other equipment used in modern electronics. Typical uses are in computers, radiation counters, lifts, digital voltmeters and cash registers. It is only 1 1-8 inches in diameter and 1¼ inches in overall length.

The numerals are 1 cm. (approx. .4in) in height, and with the typical anode supply voltage of 170 volts, glow brightly with the usual reddish light. Thus the figure can be read at a considerable distance, particularly if the tube is shielded from strong ambient light. The cathodes normally draw about 2 mA, and the recommended typical anode load is 20,000 ohms.

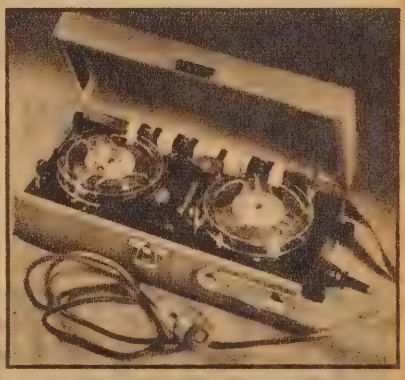
The tube is normally available with cathodes shaped into the numerals from 0 to 9, for normal decade indication. However, we understand that it can be supplied with quite a variety of other figures on special order. We also understand that this tube is the first in a series of future indicator tubes to be released in Australia.

The list price of the tube is quoted as £3/16/7 plus 12½ per cent sales tax, and inquiries should be directed to the manufacturers.



PRICE CORRECTION

Messrs Simon Gray Pty. Ltd., 28 Elizabeth Street, Melbourne, have asked us to announce that, due to an unfortunate misunderstanding, the price of the "Fi-cord" tape recorder featured in last month's Trade Review was incorrectly quoted.



The correct price structure is as follows: The recorder, complete with special microphone, one set of batteries, and one spool of Scotch tape, retails for £121. The automatic battery charger is available as an extra at £16/11/.

7 STORES

MAXWELL'S

Famous for Fair Dealing since 1918!

MELBOURNE'S LEADING TAPE RECORDER SPECIALISTS

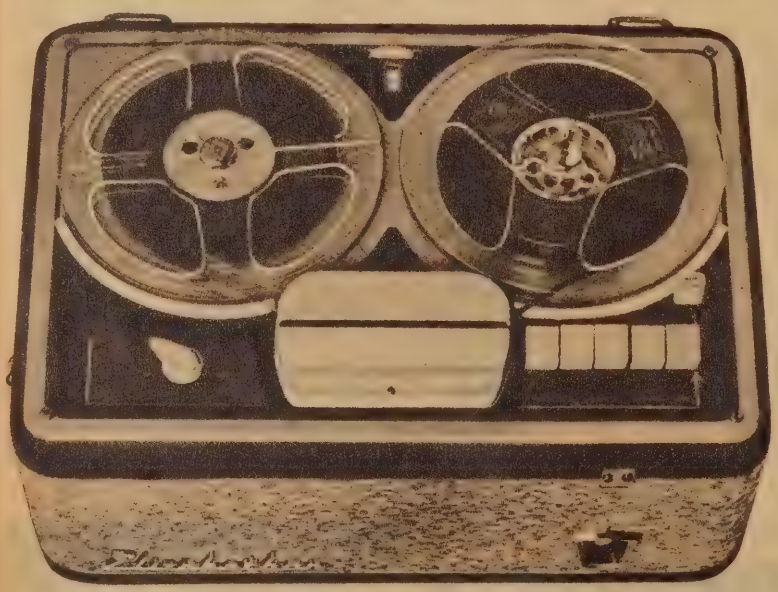
proudly present for the FIRST TIME IN AUSTRALIA the new ALL BRITISH

Elizabethan SERIES

TAPE RECORDERS

THE PRINCESS

An amazingly versatile THREE-SPEED recorder with simple push-button operation! Facilities for super-imposition, mixing and listening as you record give wider recording scope than ever before. Record your own entertainment for parties and fun . . . thrill to the clear, true-life reproduction . . . enjoy up to four hours' playing time. Order the Elizabethan Princess now by phone or mail, or call at Maxwell's Radio for a no-obligation demonstration.



SPECIFICATIONS:

Three Speeds: 7½, 3¾, 1 7/8in./sec.
Frequency response: 7½in 60-12,000, 3¾in 60-8,500, 1 7/8in 60-6,000 c/s.
Playing time: 2 hours per track, total 4 hours, with standard 1,200ft tape.
Rewind time: 2 minutes.
Controls: Deck—simple interlocked push-buttons, pause control, safety erasure lock.
Amplifier—volume control, combined tone control and mains on/off switch becoming monitoring level control during recording.
Record level indicator: Magic Eye (EM85).
Position indicator: Digit counter.
Output: 3½ watts.
Loudspeaker: 7in x 4in high-flux elliptical.
Inputs: Mic. and Radio-Gram.
Outputs: Monitor, Ext. L.S. (3 ohm).
Valves: 12AX7, ECL82, EL84, EM85, C3B.
Size: 14in x 11½in x 6¾in.
Weight: 23lb.

Ridiculous low price for this brand-new 3-speed unit.

only 89 gns.

Dep. £9 and easy wkly. payments.

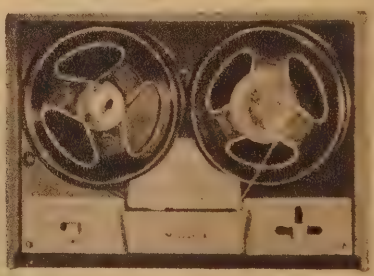
Terms available only in Metropolitan area.

THE AVON (AT RIGHT)

Efficient, compact recorder with full-range of recording facilities . . . easy-to-operate two deck controls . . . magic eye recording indicator. Ideal machine for business or home use. £7 deposit and easy weekly terms. Cash price,

65 gns

£7 DEP. and easy weekly payments.



SPECIFICATIONS:

Speed 3¾in./sec.
5¾in spool, giving 1½ hours' playing on 850ft tape.
Mixing and super-imposing of two programs.
Frequency range 60-10,000c/s.
Four-stage amplifier, 2½ watts output.
Speaker: 7 x 4in elliptical.
Amplifier volume and tone controls.
Independent Amplifier.
Inputs: Mike, radio player, telephone attachment, etc.
Outputs: Headphone, external L.S.
Size: 14 x 7½ x 10in.
Weight: 16½lb
Fully guaranteed.

MAXWELL'S

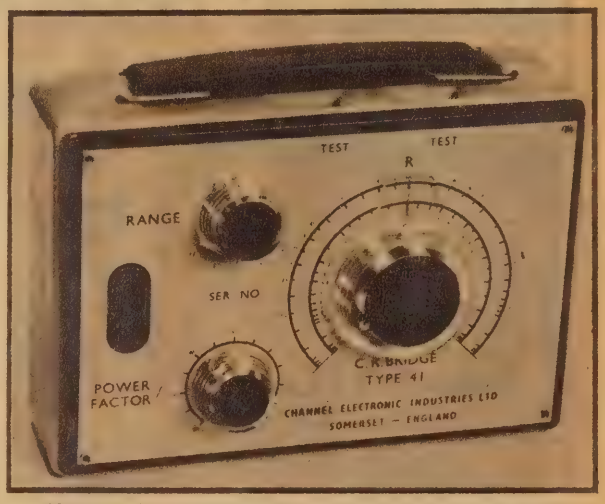
TAPE RECORDER CENTRE

358 Lonsdale St., Melbourne. (Cnr. Elizabeth St.)
Phone MY 1351

Also RUNDLES, 146 Rundle St, Adelaide. Phone W5598.

TRADE REVIEW — TRANSISTORISED INSTRUMENTS

Two new miniaturised test instruments just released in this country by Messrs. Watkin Wynne Pty. Ltd. should be of considerable interest to servicemen, technicians and home constructors. They are the "Channel" transistorised R-C Bridge and Signal Generator, both measuring only 4-5/8in x 3-3/8in x 1-1/2in.



Above is the R-C Bridge. The signal generator is similar in size and appearance.

THE R-C Bridge type 41 has four ranges, two for capacitance values and two for resistance values. The capacitance ranges are 5 pF-0.2 uF and 500 pF-20 uF, and the resistance ranges 5 ohms-200K and 500 ohms-20M. In addition, a power factor control is provided for the higher capacitance range to check the "quality" of larger value capacitors.

A Mullard DM70 miniature indicator tube is used as a null indicator. This is a "tear-drop" or "exclamation mark" indicator, which indicates the null when the glowing line reaches its maximum length. The null in this instrument is quite sharp, and the tube is well shielded, so that it is easily viewed under normal conditions.

The balance control is fitted with a reasonably large knob having a hair-line cursor, and the scales for C and R are quite finely marked. Thus accurate reading of values is possible. The makers claim an accuracy of 1 per cent on the lower capacitance range and the two resistance ranges, and 5 per cent on the higher capacitance range.

BATTERIES

The instrument operates from three batteries, two miniature 1½-volt types being used for the filament of the DM70 and one small 9 volt type for the actual bridge circuitry. Total consumption is quoted as very low, giving long life for the batteries.

The unit employs printed circuit techniques throughout and the case is made from high-impact polystyrene, fitted with a fold-flat carrying handle. The consumer price is quoted as £17 complete.

The Signal Generator type 40 is built along similar lines to the Bridge, with the exception that it is fully shielded inside the plastic case. It is fitted with an audio ouput socket in addition to the RF outlet, so that simple audio tests can be performed. The RF output can be either modulated or CW, and the modulation depth is fixed at approximately 30 per cent. The 1,000 c/s audio signal available at the audio socket has its own attenuator.

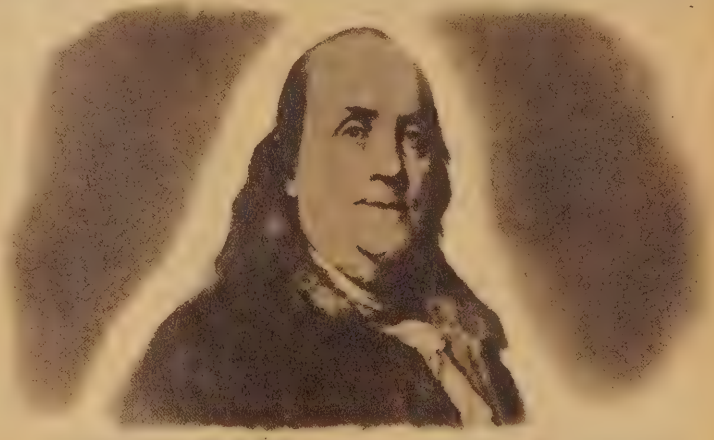
FIVE BANDS

The instrument has five bands, covering the range from 115 Kc/s to 20 Mc/s with satisfactory overlap in the band coverage. A large knob and fine-line cursor moving over a clearly marked dial give a quoted accuracy of 2 per cent or better.

A printed circuit is used as before, and the unit uses a single 9 volt transistor battery. The RF output is smoothly variable between 1 and 100 millivolts, while the audio output is variable from near zero to about 8 volts.

The consumer price of the Signal Generator is quoted as £18 complete with coaxial test lead. All inquiries regarding these instruments should be directed to Watkin Wynne Pty. Ltd., 21 Falcon St., Crow's Nest, N.S.W.

WHAT SECRET POWER DID THIS MAN POSSESS?



Benjamin Franklin
(A Rosicrucian)

WHY was this man great? How does anyone—man or woman—achieve greatness? Is it not by mastery of the powers within ourselves?

Know the mysterious world within you! Attune yourself to the wisdom of the ages! Grasp the inner power of your mind! Learn the secrets of a full and peaceful life! Benjamin Franklin—like many other learned and great men and women—was a Rosicrucian. The Rosicrucians (NOT a religious organization) first came to America in 1694. Today, headquarters of the Rosicrucians send over seven million pieces of mail annually to all parts of the world.

THIS BOOK FREE!

Write for YOUR FREE COPY of "The Mastery of Life"—TODAY. No obligation. No salesmen. A non-profit organization. Address: Scribe T.G.E.

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Box 3988, G.P.O., Sydney, Australia.
Please send me the *free* book, *The Mastery of Life*, which explains how I may learn to use my faculties and powers of mind.

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The ROSICRUCIANS
(AMORC)
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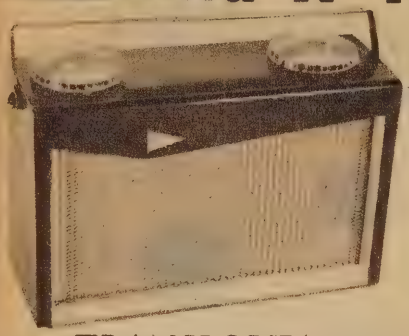
MAKING A TRANSISTOR PORTABLE?



TRANSPORTA 4

Complete Kit of Parts for Transporta Four as featured in October Radio and Hobbies, including Cabinet as used with the Transporta.

£16-17-6

LESS CABINET, £14/7/6.

Most parts used in the Transporta Four can be used for the Transporta Seven should a larger set be required at a later date.

NEW 6V RECORD PLAYER, £7/15/-

These new 4-speed Record Players are supplied with turnover crystal pick-up and sapphire needles, and are suitable for use with the above or any transistor radio.
Postage and packing extra.
N.S.W. 10/; Interstate 15/-.

COMPLETE KIT OF PARTS for the TRANSPORTA SEVEN

£25/17/6 SET WIRED AND TESTED £2/10/- EXTRA

Complete kit of parts for the Transporta 7 as featured in Radio and Hobbies, including 7 S.T.C. Transistors, Printed Circuit Boards, Coil Kit, Rola 5F Speaker and Transformers and all necessary parts to complete this set including attractive and durable two-tone cabinet with gold trim. Fitted with special aerial coil and plug to connect to your car aerial or external aerial making it an ideal car set or for use in the country.

POSTING AND PACKING EXTRA on transistors 4 or 7 sets. } **N.S.W., 15/-. INTERSTATE, 22/-.**

STEREO AND AUDIO LEVEL INDICATORS

Designed for checking balance in stereo amplifiers or checking output of stereo or monaural equipment. Can be used as output meter. Simple to use, connect across voice coils of speakers. **£3/18/6**

Post and Packing: N.S.W., 3/6; Int., 5/6.

NEW 12in PER MAG SPEAKERS

These Standard Speakers by leading manufacturer (we cannot advertise the make) are supplied less transformer.

47/6 Packing extra. **Post, N.S.W. 10/-; Interstate 12/6.**

9in x 6in OVAL SPEAKERS

37/6 Post, N.S.W. 7/6; interstate 11/6. Plus packing.

Transformers for above speakers 5,000 or 7,000 ohms, 10/-.

BATTERY CHARGER RECTIFIERS

New Selenium Rectifiers, 6 or 12 volt, at 4 amp. 37/6.
Post, N.S.W. 7/6; interstate 10/-.
Transformer for above rectifier tapped for 6 or 12 volt, with circuit for charger. 47/6
Post, N.S.W. 7/6; interstate 10/-.

TAPE-RECORDER MOTORS

New Collaro Tape Recorder Motors, 240 volt, A.C. Adaptable for many uses. **37/6** Post extra.

CONDENSER SPECIALS

Boxes of 100 new ceramic, mica, paper and electrolytic condensers in values ranging from 50pf mica to 5 400v paper. Values include .0001, .00025, .00075, .02, .05, 1. Also 500 mfd/12v., 8 mfd/525v., 16 mfd/350v., electrolytics.

25/- per 100.
Post Extra: N.S.W., 2/6; Int., 3/6.

CONDENSER SPECIALS

100 new mica paper and ceramic condensers, mixed values.

15/- Post 2/.

NEW I.R.C. RESISTORS

I.R.C. carbon resistors, ½, 1 and 2 watt, in values 5 ohms to 5 megs., including many popular sizes. 3T, 15T, 20T, 50T, 100T, 250T, 500T, etc.
(Standard resistor colour code supplied.)

100 for 25/-. Plus 1/6 postage.

NEW METER RECTIFIERS

Westinghouse 1 mA rectifiers, 15/.

ELECTROLYTIC CONDENSERS

New Dubilier pigtail condensers.

8mfd 525v .. 2/9
16mfd 600V .. 5/9

Post Extra

TV OR AMPLIFIER POWER TRANSFORMER

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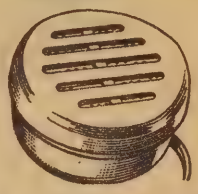

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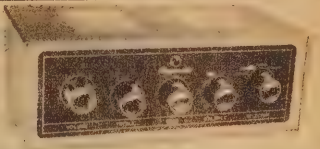

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1T4	4/6	EK32	6/9	1K7G	3/	6U7G	5/
3S4	10/	6SA7GT	9/6	1L5	9/6	6J7G	5/
1R5	10/6	6SH7	5/6	6C8G	5/	7C7	3/6
1A7GT	9/6	105G	4/	6SS7	8/6	78	7/6
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6B6G VR55	5/
6V6GT	12/6
VR65A	2/6
41	7/6
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Number of Heads	Two.
Head Types	One Record/Playback, one Erase.
Heads, Additional	Space provided for the fitting of a monitor head or a stereo playback head.
Record Head Gap	.00025".
Record Head Impedance	30 K ohms at 10 KCS.
Attainable Frequency Response	12 KC at 7½" per second ± 3 db with Record/Playback equalisation.
Recommended Erase & Bias Frequencies	45-60 KCS.
Erase Head Impedance	200/300 ohms at 45-60 KCS.
Erasing Voltage	Approximately 25 volts at 120 M/A.
Playing Time	120, 60 and 30 minutes per standard 1,200 ft. reel.
Rewind Times	65 seconds per 7" spool of 1,200 ft. 45 seconds per 5¾" spool of 850 ft.
Wow & Flutter	Not greater than .15% at 3¾" p.s.
Long Term Speed Stability	Better than .5%.
Dimensions	
12½" x 10⅜"	With 5¾" spools within the confines of the Unit Plate. With 7" spools overlapping Unit Plate.
Plane of Operation	Horizontal.
Weight	14 lbs.

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100W. AMPLIFIER

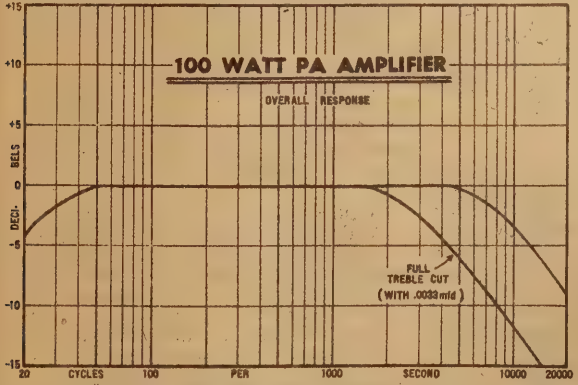
(Continued from Page 35)

and a chassis return is quite satisfactory (and a good deal easier) for the remainder of the valves, this is not advisable for the first stage.

The best arrangement appears to be a twisted pair running from the transformer terminals to the heater pins, the chassis connection being made near the power transformer, rather than at the EF86 socket.

The only remaining source of hum is a small amount of magnetic coupling between the power transformer and the EF86; always a possibility where we seek the convenience of a high gain amplifier on a single chassis. The amount of hum thus introduced is quite small, and is unlikely to be a problem except where low output microphones are used. In any case the cure is relatively simple.

The magnetic field is so weak that it may be effectively "shielded" by nothing more pretentious than a steel (tinplate) valve shield. This is available in at least one brand, the Philips type B8700/55 combined socket and shield.



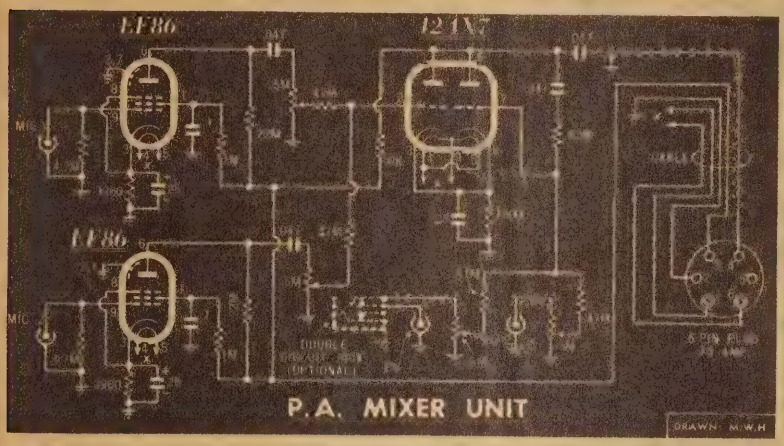
Frequency response is dependent mainly on the output transformer. That shown should be more than adequate for any P.A. requirement.

The "55" indicates the tinplate shield, but this point can be checked with a magnet. We suggest that this type of shield be fitted as a matter of course.

Input to the microphone channel for full output is of the order of 5mV, so that a fairly wide choice of microphone is possible. The better it is, in terms of frequency response, the less will be the troubles experienced with acoustic feedback.

In considering the mixing facilities which should be provided in an amplifier of this kind we decided to repeat the arrangement used in the 35 watt P.A. amplifier of April 1958. This provides for one microphone and one pickup input circuit, at appropriate levels, and a simple mixer network, whereby these may be adjusted separately for any desired balance.

Such an arrangement has the advantage of simplicity, both as regards the circuit and the number and function of controls (P.A. systems often have to be operated by relatively unskilled personnel), yet is adequate for almost all the normal jobs where a P.A. system is required. Thus, in most cases, the amplifier may be used as a completely self-contained unit.



Circuit of the P.A. Mixer Unit, which may be used if required to provide more elaborate mixing facilities than available in the main amplifier. By its use, three microphones and two pickup channels are provided.

However, for those occasions when something more elaborate is required, as when the local amateur dramatic society needs a system with "everything that opens and shuts," provision is made to fit a separate mixer unit which, with the mixing facilities already in the amplifier makes a very versatile combination.

The mixer unit provides for two microphone and two pickup channels, all independently controlled. The output of the mixer unit feeds into the pickup circuit of the main amplifier, the associated control now becoming a master control, which is a useful feature in itself. In addition, the original microphone channel in the main amplifier may still be used, making three microphone channels in all.

(Continued on Page 109)

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Let's Buy An Argument

A reader from Blackburn, Victoria is puzzled about a question which is often answered only in part. Though it is a little difficult to think clearly when lying prone in a hospital bed, I will do my best to make suitable explanation.

by Neville Williams

DISCUSSING the subject of loads as presented to output valves, he writes as follows:—

In reference to P to P load of Push-Pull Output Transformers.

If we take a triode designed to work into a plate load of say 4,000 ohms single ended Class A, I have always understood for the same operating conditions in push-pull, the figure would be 8000 ohms. Therefore as the turns ratio between one half of the pri. and the sec. is halved, the impedance ratio of one half of the transformer must now be 2000 ohms.

(a) Does the tube "see" only half the winding, which appears as 2,000 ohms, or does the other half reflect back also, to give an effective load of 4,000 ohms? (i.e. 4,000 ohms in one half only of the pri.).

(b) Or does the tube actually work into a 2,000 ohm load which would be much closer to its actual plate res., it being able to do so, because in a push-pull circuit, distortion will not be so apparent?

(c) Or does the tube "see" the total winding, which although it is 2,000 ohms for each tube, appears as 4,000 ohms to one tube? (likened to two 2,000 loads in series).

When discussing the matter of valve load resistance, it is well to start right from the beginning and be satisfied to answer our correspondent's question when we ultimately come to it.

DEEPER STILL

Of course, if you want a really scholarly treatise on loads and their relationship to the output valve (or valves) one need not go beyond Australian author Mr F. Langford-Smith in "The Radiotron Designer's Handbook" and elsewhere. Mr Langford-Smith discovers so many problems and compromises that it is with a little wonder that we recall that the sounds which issue from a loudspeaker are usually recognisable.

However, that is by the way.

In considering the matter, it is first necessary to realise that given valves do not have automatic and precise values of load into which they must work. Rather is the published value of load a deliberate compromise, which is affected by whether the valve is a triode or tetrode or pentode, the voltage conditions under which it works, and whether connected in single or push-pull output.

This being so, valve manufacturers normally publish sets of "typical operating conditions" for individual valves relating likely or useful sets of voltages and currents, drive conditions, bias conditions, power output and distortion level.

POWER VERSUS DISTORTION

In most cases, a higher figure of power output could be indicated if a higher figure could be allowed for the published distortion level. Changing the value of load would affect the values of both.

Normal practice is for manufacturers to examine the characteristics of individual valve types and using both graphical analysis of the curves and practical tests, to choose a value for the load which, for the particular conditions, yields the highest power output for an acceptable level of distortion.

As we have pointed out on other occasions, it is sometimes wrongly supposed that this value of load is constant for the particular valve; that a 6V6, for example, operating in class A conditions, always needs a 5000-ohm load.

It does—for the usual 250-250-minus 12.5 conditions. But work things out for distinctly different voltage levels and there is every chance that the optimum load will emerge as a higher or lower value.

Another point is that the figures of distortion and power output presuppose an ideal type of load—one which inserts zero D.C. resistance in the valve's plate return circuit, yet is entirely and purely resistive in terms of the impedance presented to the alterations of plate current at signal frequency.

PRACTICAL SET-UP

For practical tests, the requirement can be approached but not fully realised by supplying the plate through a choke having very low D.C. resistance, yet high inductance and a minimum of shunt capacitance. This is shunted, in turn, by a resistor having a value equal to the requisite dissipative load resistance.

The nature of the load presented by the usual output transformer and loudspeaker is far from ideal and leads to some of the difficulties explained, as aforementioned, by Mr F. Langford-Smith.

In general, the difficulties are most acute with pentodes and tetrodes and are diminished by the use of negative feedback and are least with triode and ultra-linear circuits. (Please let's not argue here as to whether the ultra-linear system is a feedback circuit.)

Our correspondent's problem arises from the further question of push-pull operation. He supposes that two valves, each normally requiring a 4,000-ohm load, are to be used in push-pull class-A, with a value which automatically becomes 8,000 ohms plate to plate.

DOUBTFUL ASSUMPTION

In fact, I am inclined to question the concept that, for a pure class A amplifier, the plate-to-plate load is exactly double that for the single-ended connection. I know it is so in some cases and is assumed to be so in others, but that scarcely proves it as a general rule.

My reason for saying this stems from the earlier remarks.

Because the push-pull connection automatically cancels most of the even order distortion, it reopens the whole question of load, power output and distortion.

While I have no opportunity of cross-checking the facts from my present physical position, I expect that a new assessment of the position would yield optimum figures which are not necessarily simple resultants of the single-ended conditions.

Be that as it may, the reflected load could be double, if required, by winding on root 2 or 1.4 times as many turns on the primary winding, and providing an appropriate centre tapping.

This would give a plate-to-plate impedance of 8,000 ohms, centre tapped. This ostensibly provides 4,000 ohms per side.

But this doesn't seem right to our correspondent. He points out, quite rightly, that each valve now "sees" only 0.7 times the former number of turns and therefore only 0.5 times the former impedance. Each valve seemingly works into 2,000 ohms so that even a traditional push-pull class-A stage is not a double-up of the single-ended stage.

COMPLEX FUNCTION

The fact of the matter is that there is more to it than a simple impedance ratio.

In figure 1, V1 "looks at" the load through a transformer impedance ratio which reflects from R an apparent value of 2,000 ohms. In other words, when the plate current of V1 varies at an audio rate with grid input signals, a voltage is developed across the plate circuit, exactly as if it were being developed across an AC load of 2,000 ohms.

But wait. Is that true?

In a balanced push-pull circuit as for figure 1, the effect of every movement of current in V1 is supplemented by an exactly similar movement of the current from V2. Thus, for any given change of current through V1, there is twice the expected voltage change across the final load resistor R.

In fact, because the action of each valve is supplemented by its opposite number, it appears to either one individually, that the load into which it is working is twice the value which it actually is.

Thus the apparent load for either valve is 4,000 ohms.

You are dubious?

Let's say that, by actual trial, you had established that you could just manage

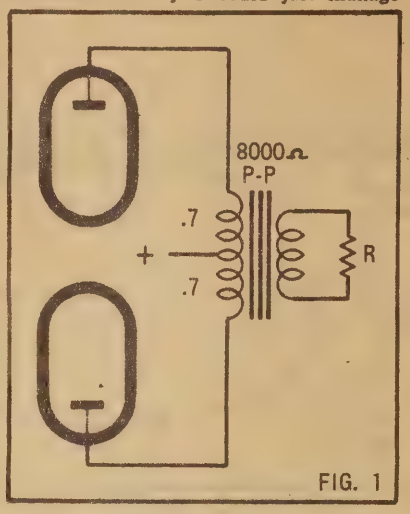


Fig. 1. What load does V1 "see" reflected from "R" across the transformer secondary? 4,000 ohms or 2,000 ohms?

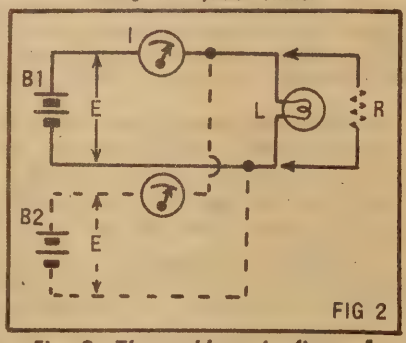


Fig. 2. The problems in figure 1 may be easier to follow when we reduce it to a simple DC circuit as above. What resistance does each battery "see" in the lamp?

to push a one-ton car up a certain incline. You had done it so frequently that you were quite sure of your abilities and your limitations.

Then, one day, a two-ton vehicle has to be pushed up the said incline and, by rallying the help of another man of similar strength to yourself, you just manage the feat.

HALF EACH

Because each is supplementing the efforts of the other, what is actually a 2-ton load appears to either one individually as a one-ton load.

Or, if you prefer it, you can have a simple electrical analogy using batteries and a torch globe, as in figure 2.

A battery B1, of voltage E, is being used to light a torch globe L, the current flowing in the circuit being I.

As far as the battery is concerned its power is being delivered into a load R, equal to E/I.

Now, without telling Battery 1 what we are up to, we introduce a second and identical battery across the globe terminals. Neglecting the more remote factors like battery internal resistance, the globe will not light any brighter, all that will happen will be that the current drawn from B1 will drop to half its former value, so that both will be supplying current I/2.

If we could ask B1 what had happened and B1 had the ability to reply, it would assert that, since its voltage remained unchanged but the current had dropped to half, the value of the output load must mysteriously have doubled, being now equal to E/.5I.

APPARENT CHANGE

But of course, we know different. The load had not really changed; rather a second symmetrical source of energy has merely changed its apparent value, as far as either battery is concerned.

As with the batteries, so with the output valves.

But note that we have been speaking thus far of a pure class-A stage, in which the excursions of each value in the pair are ideally symmetrical. (What we have said is not true of all push-pull systems).

Consider the case of class-B in which each valve works only over one half the cycle, from cut-off to the limit of its conduction. In this case one valve does not supplement the other by supplying simultaneous power to the load.

Therefore each looks into a load which is simply the resistor R multiplied by the square of the ratio half-primary to secondary.

It follows that, in between these two extreme conditions there must occur intermediate conditions of class AB1 and AB2, wherein one valve supplements the action of the other over portion only of the cycle, and that for relatively low signal levels.

Thus, individual valves would "see" something like half the plate-to-plate load for very low levels, gradually diminishing towards one quarter of the value towards peaks of the swing.

TOO MUCH ASPIRIN?

So there it is. I trust that the foregoing will give some food for thought. But, of course, there may be some who disagree with my reasoning, charitably supposing that too many sedatives have had their inevitable effects.

Now for a change in subject:—

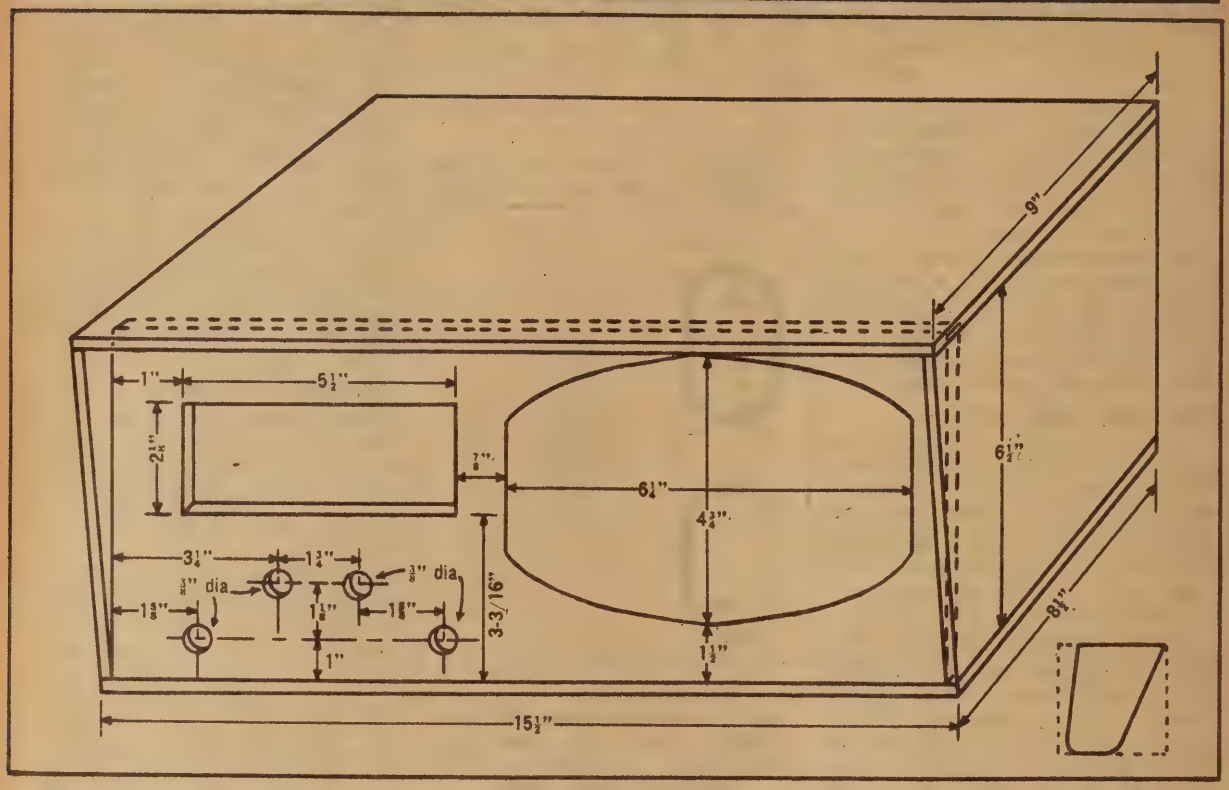
A friend was recently intrigued by a very lavish advertisement in an American paper concerning an amazing new television aerial device.

I did not see the advertisement personally but I gather that various types of conventional aerials in a series of small drawings were all shown as blotted out by bold crosses leaving only this new, simple compact device.

He reasoned that if it was only half as good as represented, it must still be a winner so, with all haste and the requisite number of dollars, he decided to secure one.

In due course it arrived — a fan-shaped moulding, from which hung a length of 300-ohm ribbon. The idea was to connect the ribbon to the appropriate

ALL ESSENTIAL DIMENSIONS AND ASSEMBLY DATA



There is nothing complicated about the construction of the cabinet proper, and essential dimensions are given here. The finish may take any form which appeals to the builder, but we are keen on the use of Formica, Laminex, or similar types of material. The inset in the lower right corner gives a cross section of the runner-type feet, which are developed from square section timber.

(Continued from Page 37)

to the home constructor, for with the aid of various moulding it is possible to achieve more than acceptable results.

For our present requirements we selected profile 1002. Its broader side is almost 3/8in wide, suitable for lapping the inside edge of the dial cutout. The narrower side is fluted, with a brown marking along the central depression. Its general appearance is quite attractive.

OTHER POSSIBILITIES

We also considered the possibility of using a mould to mask the edge grain along the front edge of the cabinet. However, there was a distinct possibility of overdoing it on a cabinet of this size and making it appear somewhat gaudy. We settled instead, on a wood mould of the quarter-round type. In fact, 3/8in quarter-round mould, with some of the radius knocked off either by sanding or planing, would be admirable.

Coming to the actual constructional details, we commence with the cabinet proper. An oblique drawing of the cabinet giving the necessary dimensions, etc., is reproduced for your guidance. Referring to this, you will note that the sides, top and bottom are simply butt jointed, requiring very little skill or knowledge of carpentry.

The next step is to cut a suitable front panel with dimensions to fit the inside of the box, allowing for the covering fabric. Locate and mark the various cutouts, then proceed to cut them out carefully. The panel is now ready to be covered using a suitable material. Cut the material with a ½in border all round, then lay the front panel over this, aligning it correctly and keeping the direction of the weave parallel with the sides of the panel.

To attach the material to the panel, we have found the ordinary office stapler to do an admirable job. Staple or tack one edge at first, turning it over evenly to avoid distorting the weave pattern on the front. Then proceed with two sides, stapling them alternately every two or three staples to maintain even tension. Finally, turn over and staple the remaining side.

The next step is to cut the material to clear the dial cutout and the holes for the control spindles. Then staple the loose edges of the fabric right around the dial cutout, keeping as close to the edge as possible, so the staples will be hidden by the narrow edge of the moulding.

OUT-OUTS

Now we may commence fitting the profile moulding around the dial cutout. Cut the moulding to size, then mitre the ends. To accomplish this successfully it will be necessary to make up a mitring jig from a short piece of angle iron.

Cut the ends of the angle iron at 45 deg. angles, place the jig in a vyce, then place the moulding in the jig and file the ends to a 45 deg. angle, in the appropriate direction, using the jig as a guide. Do not attempt to saw the moulding as a rough edge will result. The only successful method of cutting, besides using the guillotine, appears to be filing.

Having cut and mitred the pieces of moulding, fit them in place around the dial cutout, using contact adhesive.

Some care is necessary when fitttng the laminated plastic board. First cut sections to fit the top and sides of the box, allowing for some overlap on the corner edges. Spread contact cement on both the board and the box surfaces and allow it to become tack free. Carefully align the front edge without making contact and, when it is level, lower first the edge and then the rest of board gently on to the cabinet surface. Apply a certain amount of pressure to the work for better adhesion.

Trim the excess laminate and lightly plane the corner edges where the top meets the sides, to produce a small arris.

It now remains to fit the quarter mould to the front edges of the cabinet. This may be fixed in place by means of glue and panel pins, taking great pains to punch the panel pins neatly and avoid making a larger than necessary hole. The holes should be filled with putty, stained together with the exposed section of the inside face of the cabinet immediately in front of the panel, and the lot lacquered with an appropriate lacquer or other finish.

The fitting of runner type feet and painting them, should complete the construction of the cabinet. A developmental drawing showing a cross sectional view of the feet, which are derived from a length of 1in x 1in timber, is reproduced in the lower right-hand corner of the main cabinet diagram.

LET'S BUY AN ARGUMENT -- CONT.

aerial terminals of the receiver and clip the bakelite fan to the power flex, so that the latter rested along a channel running the whole length of the moulding.

My friend followed the instructions religiously and turned expectantly to inspect the picture on the screen.

It was a drama enacted in a snowstorm which presumably had elements of the occult as well, because most of the characters in the scene appeared in duplicate.

But when the same kind of drama appeared on the adjacent channel and the usually austere A.B.C. appeared to be delivering its news service in the same form, he began to have doubts.

Being of a somewhat curious and technical turn of mind, he took a piece of ordinary 300-ohm ribbon, attached one end to the receiver aerial terminals, split the other end for about 15 inches and laid the separated wires across the top of the cabinet.

GHOSTS EXORCISED

Forthwith, the "snowstorm" effect disappeared and, with it, most of the ghost problems.

My friend was naturally irate. "Why should such advertising be allowed . . .

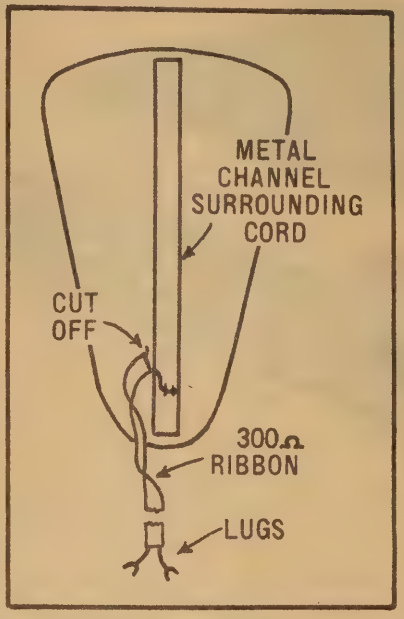
At the moment it is an American problem but one never knows when it could become local.

Prising the back off the device in question — which proved to be quite a job — revealed that one of the ribbon leads was simply cut off a couple of inches inside the moulding, "going no place else," as the Americans would say.

The other lead connected to a long metal channel along which the power cord to which the device was clipped would run. Thus, ostensibly, the whole thing was an "ornate" method of creating some small amount of capacitance between one conductor of a piece of ribbon and the wires in the power cord.

As with any such device, the amount and quality of the signal which reaches

This engineering marvel renders all other TV aerial designs obsolete—the makers admit it themselves!



What it really is. A crude method of capacitive coupling to the mains. No wonder the ghosts were caught in a snow storm!

the receiver is largely an "accident" of how much signal is present on the mains wiring to be picked up.

All I can say is that, unless such devices can be shown to have more qualities than those with which I have credited them, I will not be tempted personally to divert any of my "hard-earned" to purchase same.

By and large, the ability of a VHF aerial (in this case a television aerial) to pick up signal is still very much related to its dimensions, its complexity and its height above surrounding objects.

NO SUBSTITUTE

There's a fairly close parallel to the case of loudspeaker enclosures, wherein it is often agreed — "There is no real substitute for cubic feet."

And while on the subject of excessively euphemistic advertisements, I may as well mention another advertisement in a European paper which offered, for a very attractive figure, a powerful electric organ for home use, easy to play, etc., etc.

One of these also was imported — turning out to be a rather feeble reed-type instrument, rather like an elementary piano accordion, turned on its side and equipped with a small electric blower.

There are, of course, plenty of such instruments on sale and they have their place in the scheme of things. But they are hardly sufficiently sophisticated to deserve the aura of beautiful, powerful, electronic organs.

But it's still wonderful what a good advertising layout man can do with paper and paint.

STOCKTAKING SPECIALS

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Colour Scheme:
Terracotta red
with ivory panel.
Suitable for panel mounting
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SPECIFICATIONS:

Data refers to *one* channel, both channels are identical.

POWER OUTPUT 7.5 watts
OUTPUT IMPEDANCE 15 ohms
FREQUENCY RESPONSE
40c/s — 20Kc/s within plus-minus 1dB
DISTORTION
0.5 per cent at 1Kc/s, 6 watts
HUM & NOISE
—60dB (all input sockets).
SENSITIVITY & INPUT IMPEDANCE
Magnetic P.U.: 4—6mV. 56K ohms.
Crystal P.U.: 150mV. 780K ohms.
Tape or Radio Input 1: 400mV. 100K ohms.
Tape or Radio Input 2: 1V. 100K ohms.
CROSS TALK BETWEEN CHANNELS Better than 60dB.
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Loudspeaker phase reverse.
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For magnetic P.U. to B.S.S. 1928 (R.I.A.A.)
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Bass plus 10, —15dB at 50c/s.
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AUXILIARY O/P SOCKET
1V at 100 ohms impedance for driving additional amplifiers or for connection to tape recorders.
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A.C. mains supply to Gramophone motors.
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100-150V, 200-250V. 50/60c/s input 90 V.A. for complete amplifier.
VALVES
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The demand for a **high quality, integrated high sensitivity stereo amplifier** has existed for a long time. It has now been met at long last, and the superbly designed, easy-to-operate attractive unit featured above is now available. It is suitable for ALL available pickups

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BOOK REVIEW

RADIO AND TELEVISION ENGINEERS' REFERENCE BOOK, Third Edition. Edited by J. P. Hawker. Hard cover, 7¼in x 5in, over 1,800 pages. Contains circuits, diagrams and photographs.

This book fulfils well the aims implied by its title — it is an engineer's reference book. It certainly does not contain all the data needed by radio and television engineers, for no publication ever could. What it does—and does well —is present in a clear and concise manner a great amount of theory and information on many subjects in this field.

It is thus well qualified to take its place upon the shelf assigned for engineers' reference books. The book is an English publication and is a compilation of works from 47 specialist contributors.

This, the third edition of the handbook, has been brought completely up-to-date (1960) and several new chapters can be perceived. Among these are chapters on Germanium and Silicon power rectifiers, transistor DC converters, transistorised broadcast receivers, servicing transistorised equipment, radio astronomy and space probe communication, and high fidelity (including compatible stereo).

CHAPTERS REVISED

Many chapters have also been revised in the light of modern developments. Thus enlarged chapters are presented for Transistors and Semiconductors, Valves, Broadcast Receivers, Pickups, Tape Recorders, Television, and Aeronautical Radio and Radar Equipment. Other chapters have been recast and expanded due to new techniques. The chapter devoted to radio servicing, for instance, contains quite a lot of new material on printed circuit boards.

As is usual in reference books of this type, a section near the rear is devoted to data tables, definitions, unit conversions and other valuable information.

Finally, the book has a section given to a discussion of the latest advances in various fields. Among other brief topics given here is a discussion of British experiments in colour television.

The book is published by George Newnes Limited of London, and the Australian price is £7/11/3, plus 7/ registered post. Our copy was from the Technical Book and Magazine Co. Pty. Ltd., of 295-299 Swanston Street, Melbourne. (J.R.)

TV CABINETS

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TV CHASSIS, several well-known make, ½ complete £8

STEREO CHASSIS, 10 only, ½ complete £7/10/-

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MONTHLY NEWSLETTER

We would like to start out by apologising to the hundreds of readers who wrote in requesting literature and full technical specifications on the range of American equipment which we mentioned in our last Newsletter; specifically Fisher and Rek-O-Kut.

I would like to take a minute here to explain that genuine literature from the manufacturer is very difficult even for us to come by and we only receive a limited quantity, thus a few thousand copies of half a dozen types go absolutely nowhere when we receive twice as many requests for same. However, within the next week or so we expect much greater supplies of this literature and hope to be able to fulfil all the requests which we have had.

We were overwhelmed with the popularity of this gear and if some of you are disappointed in not being able to obtain the items you require please do not despair as constant shipments are arriving and we should soon be able to offer it all ex stock.

On one of our other pages in this issue we are showing some photos of some new radio direction finders which will be of particular interest to small boat owners. The outstanding performances and good appearance, combined with the low price structure, is making these very popular with our Melbourne customers and we are looking forward to receiving inquiries from many of you in other States.

We also hope that by the time the next boating season comes around we will have had the opportunity to stage, in many seaside and lakeside resorts, full demonstrations of our marine electronic equipment, thus giving many of you the chance to try out these items on the spot under actual conditions.

Of particular interest this month might be a new shipment of Pioneer amplifiers, stereo models, complete with AM, FM, Short Wave radio tuners, ranging from as low as £85 up to £170, complete. These are one of the most popular items we have ever been able to offer and we know that there are many satisfied users now throughout Australia.

Also, elsewhere in this issue you will see a close-up photograph of the internal arrangements of the new Grundig FA.40 TV camera. This camera is entirely self-contained, only connections required being to power mains via a small stabilised power supply which is supplied and a connection to the antenna terminals of any television receiver. The units radiate within the limits of Channel 5 (or any other Channel to be specified) and have an output of 150 mv. rms. The definition exceeds 450 lines and sensitivity is equivalent to film speed 50 asa. These should be very popular with experimenters as, for less than £500, an amateur can completely equip his own studio using this type of equipment.

We are at the moment doing laboratory tests on a few new lines of equipment and next month will be presenting all the technical details to you with the thought that they may be of interest. We welcome any inquiries or queries you might have and look forward to seeing many of you in our showrooms shortly.

Incidentally, as a final note, some of you might be interested to know that we have a small supply of complete console TV cabinets at £5 each, polished and if you wish to inspect these we will be only too glad to have you do so.

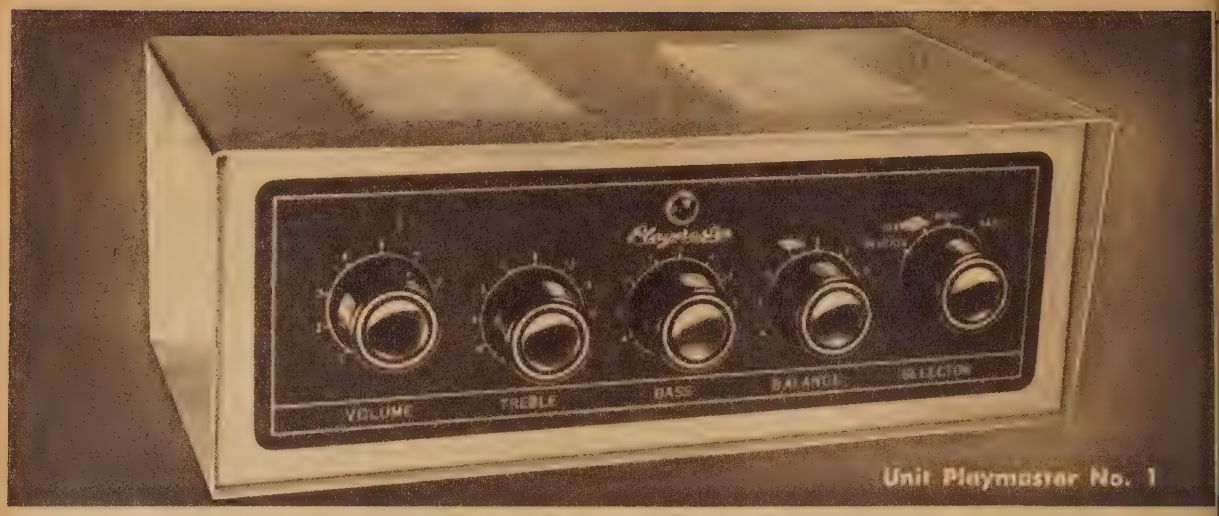
Yours,

UNITED ELECTRONICS (A/ASIA)

PTY. LTD.,

31-33 Camberwell Road,

Camberwell Junction. **Phone: WB3333**



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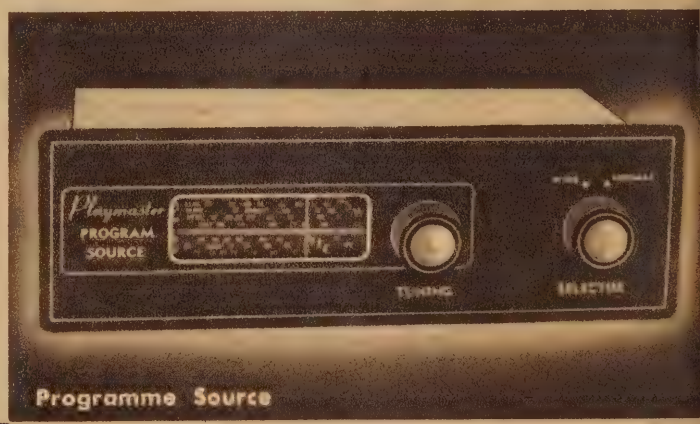
At right is the Programme Source, absolutely the smartest tuner yet.
Top right, the 10 Watt (per channel) Stereo Amplifier with separate pre-amp.
Above is the latest Unit Playmaster No. 1, a 2½ Watt (per channel) amplifier with inbuilt pre-amp. All escutcheons on Playmaster stereo equipment are beautifully anodised in deep bronze with gold lettering.

For quick service, send coupon or write to "BROADWAY ELECTRONICS" Section for Descriptive Catalogue.



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- Wide Band Tuners
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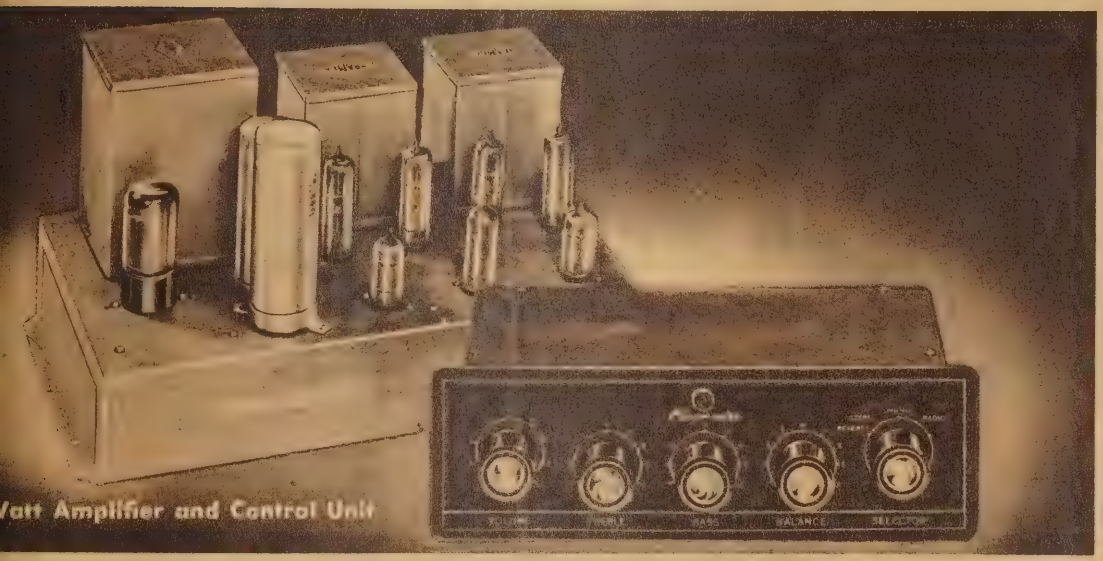
  for use with all Playmaster and most other Hi-Fi brands.



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FRINGE AREA version available.
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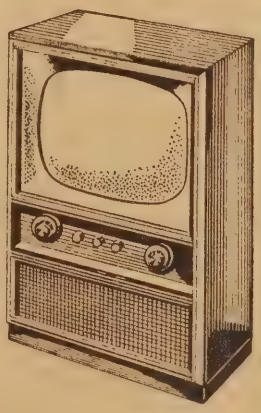

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COLUMBIA REVEALS MINIATURE TAPE CASSETTES

Despite the enormous popularity of L.P. records, the proposition of using tape as a home entertainment medium is not by any means dead. Various manufacturers are currently working on an idea and the latest to make a public announcement about their efforts is the CBS organisation in the United States.

by Neville Williams

SPEAKING at the American I.R.E. Convention, Dr Peter Goldmark of the C.B.S. Laboratories, recently exhibited prototypes of their latest efforts, worked out in association with the Minnesota Mining and Manufacturing Company (3M).

In the form exhibited by Dr Goldmark, the pre-recorded tape comes in a small cassette, measuring 3½in square and about 5/16in thick. Each contains one complete hour of music and, using the player developed to go with them, five of the cassettes can be pressed down over a single spindle, which provides the drive.

The equipment is set in motion and if you want it that way, it will supply five uninterrupted hours of music, without any one touching the controls.

And it is stereo into the bargain. The tape carries three tracks, of which the two outer ones provide the normal left and right signals for a two-channel stereo system.

THIRD TRACK

A third track in the centre is optional and is said to carry signal related to the delayed or reverberated sound which forms part of what the listener hears, when seated in an auditorium.

How is it managed?

First of all, the tape itself is narrower than normal being only 150 mils wide. On this is impressed three parallel tracks, each 40 mils wide and with a small space between them.

Furthermore the tape moves only at 1⅞in per second, which is the slowest of the recognised "standard" speeds. Normally all this would mean a severe reduction in frequency response, with increased noise level, but demonstrations indicated that any such problems had been overcome, at least in the prototype equipment.

The Editor of "Hi-Fi Stereo," O. P. Ferrel, who was present at the I.R.E. demonstration, says he heard direct comparisons between the original 15 i.p.s. tape masters and the 1⅞ i.p.s. commercial tapes, to which he had been accustomed.

There was no audible hiss and not apparent print-through effects.

To date, tape has not made any great impact on the domestic market, for a number of reasons. Its price has not helped; it has required more handling than the disc and individual items cannot be picked up as easily. Various cassettes which have thus far been devised to overcome these difficulties have simply not made the grade into mass demand.

The C.B.S. development looks to be the smallest to date, with the longest potential playing time. Since it can be loaded, played and rewound automatically, the tape itself need never be touched by hand. A 60-minute tape, by the way, needs just 20 seconds to rewind.

According to Ferrel, quoted earlier, the unit demonstrated by Dr Goldmark must not be written off as just another laboratory toy. It must be taken seriously, because its engineering and performance, even now, is on a par with the LP record in 1948 and the stereo disc in 1958.

But, he warns, only time and experience will tell whether serious "bugs" will arise when attempts are made to put it into mass production.

In the meantime, the Zenith and the Grundig concerns are actively interested, with tentative plans to release suitable players in 1961. There may be others as well. And Columbia would presumably back them by making available an adequate catalogue of releases for the same target date.

Strangely enough, one of the possible hazards of the new tape pack arises from one of its chief technical advantages—its very small size. How does one exploit the pack visually?

LP records have a tremendous advantage in this respect. They can be marketed in attractive, self-advertising jackets, with plenty of room on the reverse side for biographies and program notes.

But it is hard to glamorise a 3½in square tape pack, and equally hard to get much in the way of program information on to it in readable type.

POSSIBLE ANSWERS?

The potential manufacturers are therefore toying with the idea of booklets, packets, gatefolds and even transparencies—with none of them providing an automatic answer. It would be a strange twist of fate if an idea having much technical merit flopped because of its lack of visual attraction.

And don't think it couldn't happen!

But, of course, the technical merit of the scheme has yet to be proved. The finer that the tolerances have to be made to ensure good performance from a recording system in miniature, the worse will be the toll taken by mishaps of mass production.

It will be small consolation to tape enthusiasts and to hi-fi fans generally if the tape were to stage a "home run" as a medium for meaningless, mediocre music. A sort of offspring to marriage between a juke box and an all-day sucker!

THIS MONTH'S SACRED RECORDS

HARRY BELAFONTE, "My Lord, What A Morning," with the Belafonte Folk Singers, conducted by Bob Corman. Mono, RCA L10852.

As might be expected, Belafonte's treatment of Negro spirituals in this disc is basically traditional and very different from that by Nat King Cole, as listed recently in these columns.

Backed by a choral group, Belafonte seeks to recapture the moods which created the spirituals, avoiding the current practice of "jazzing them up."

Whether there's a place in your collection for Negro spirituals is quite another matter, for not everyone appreciates their emotional, even fanatical qualities.

This disc contains the usual dozen selections, ranging from the haunting "Steal Away" to the searching "Were You There When They Crucified My Lord?"; then on to the melodious, "My Lord What A Mornin'," from which the disc takes its title, to the boisterous, "Oh Freedom."

Technically RCA earns full marks with a recording which is completely clear and with not a trace of background noise.

★ ★ ★

PAT BOONE, "He Leadeth Me,'" accompanied by the Jerry Fielding brass choir and chorus. Stereophonic, London. SAHA 7505.

It is difficult to say more than the obvious about Pat Boone. He has a pleasant voice and a smooth presentation, which has won him a good deal of popularity. But he isn't by any means a colourful singer.

In this album of a dozen well-known hymns, Boone sings in a modest, matter-of-fact kind of way which, I imagine, will neither offend nor inspire.

He is accompanied on this occasion by a brass choir and chorus.

Typical hymns are "I Am Thine, O Lord," "Blessed Assurance," "What A

Friend," "Rock Of Ages," and "I Love To Tell The Story."

The pressing is notable for its quiet surface. Stereo balance is quite routine, but the combination of brass and voice will probably have you reaching for the controls to turn the treble down and the bass up.

★ ★ ★

"THE SPEAK FOUR TRIO." Presented by Paul Baker. Scriptural Speech-drama. Mono, GFM (Gospel Film Ministry), 14-W4012-LP.

This disc was passed over to me, more or less out of curiosity and with the invitation "See how you like it."

It's an unsual offering and, in some ways, quite amazing.

It features Mary Sue Fridge, assistant director of the Baylor Theatre, Lou Ann Klaras, one of the leading actresses, and Ruth Byers, director of the Baylor Children's Theatre. These three have worked together and developed the technique of speaking as a trio, on subject matter which began with Shakespeare, and which has since gravitated to scriptural passages.

Their diction is a lesson in itself—clear, concise, expressive. But they go far beyond this. At times they speak in unison; at times they pile phrase on phrase in rapid sequence; they snatch words one from the other; they produce vocal sound effects which illustrate the words which another is reciting.

They manage to give tremendous impact to readings which are often intoned in the most unconvincing manner.

This record may not qualify as "entertainment," but it is well worth close study by anyone who is interested in voice production, elocution or script work.. In more ways than one, this trio has something to say.

★ ★ ★

"BESIDE STILL WATERS." Played by Lew Charles at the N.B.C. pipe organ. Mono, GFM 11-W3042-LP.

The mood of this disc is very aptly summed up by the title. Lew Charles is obviously striving for a maximum degree of smoothness, and, to that end, tones down any natural crescendo and restrains any too-boisterous tempo to the point where neither will disturb the decibel meter.

The instrument used has more in common in with the "cinema" organ than the classical variety, but, while its tone is unmistakable, the organist once again avoids too flamboyant use of tone colour.

While the disc is, therefore, in no sense a virtuoso performance, it is very smooth, very easy to listen to and one of the most suitable recordings I have heard to date for "atmosphere" music before or during religious meetings.

The hymns are traditional numbers of the Sankey and Alexander variety, well-known in Protestant churches at least.

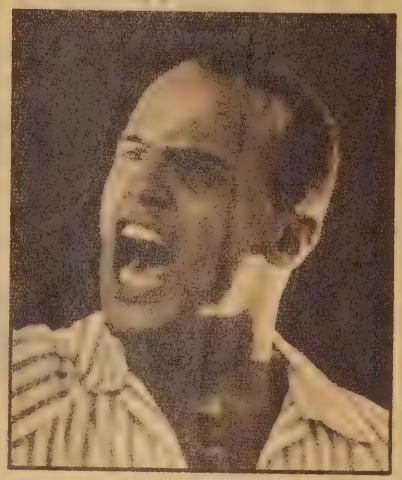
Technically, the recording is of good average quality, with just a suggestion of groove troubles on peaks in the inner tracks.

★ ★ ★

"HOLY, HOLY, HOLY," presented by the Roger Wagner Chorale, with the Capitol Symphony Orchestra. Mono, Capitol, p-8493.

The contents of this disc are as follow: "Holy, Holy, Holy," "Onward Christian Soldiers," "Swing Low, Sweet Chariot," "Ave Maria," "Jesu, Joy Of Man's Desiring," "The Holy City," "Nobody Knows The Trouble I've Seen," "The Rosary," "Finale and Chorale from Passion of St. John."

As printed on the cover, this looks



Harry Belafonte: "My Lord, What A Morning!"

a rather strange collection of titles. However, we are assured that the choice is a quite deliberate one, intended to associate various aspects of religious devotion, ranging all the way from the "Passion Of St. John," through gospel hymns and Negro spirituals to "The Rosary."

In fact, I don't think the result will sound incongruous to the intended audience. The Chorale and Orchestra in combination lend a lot of weight to everything, which becomes, as it were, a common denominator. A fair amount of ornamentation is used to build up the simpler melodies, but it is always well done.

Technically, the recording is excellent except for some deterioration of the inner tracks on side 1, due, I think, to an effort to maintain too high a recording level.

Even so, the disc still contains a lot of very good quality recording—excellent balance and definition, plenty of highs and some very solid orchestral bass.

★ ★ ★

"GEORGE BEVERLY SHEA": "Blessed Assurance," with orchestra and chorus, conducted by Norman Leyden.

By reason of his association with the Billy Graham team, George Beverley Shea is probably the best known and, in many quarters, the best liked of contemporary gospel singers. His work is consistently good and is marked by evident sincerity.

Besides "Blessed Assurance," from which this disc takes its title, Bev. Shea sings eleven other numbers which differ in title and/or presentation from the contents of earlier records. He is variously backed by orchestra and chorus, the recording being made in stereo, in R.C.A.'s New York City Studio A.

Frankly, I doubt that the stereo contributes very much in this case. Though the effect is obvious in chorus and orchestra, the two "components" of Shea's voice seem a trifle loath to get together. Often, the solo voice is more cohesive and the sound generally smoother with the equipment simply switched to "mono."

But, though I must make the point, I doubt that it will deter any Bev. Shea fan from wanting to own this latest record.

★ ★ ★

"WINGS OF PRAISE": Sung by the Melody Four Quartet and produced by Paul Mikelson. Mono., GFM 34-W3079-LP.

According to the jacket, the Melody Four Quartet is a very experienced group, made up of soloists in their own right. They have been associated since 1947 in sacred concerts all over the United States. Their names: Glen Jorian, Clair Hess, Ray Felton and Bill Pearce.

The singing of the group on this disc is outstanding in its variety and precision. Their choice of hymns, twelve in number, ranges from the traditional, through conventional gospel songs to Negro spirituals.

The accompaniments, too, are varied and in keeping with each item. Grand organ, piano, celeste, guitar, bass and vibraharp are used at various times.

Technically, the record is excellent also. Balance and definition are always good and the background noise low.

This is a record I would have no hesitation in recommending.

VARIED MOOD

"MORE MANTOVANI FILM ENCORES," played by Mantovani and his Orchestra. Stereophonic, Decca SKLA 4067.

It is doubtful whether any orchestra is better known than the Mantovani or any style more readily recognised.

In this disc his cascading strings sing their way through a dozen hits from the films, including "The High And The Mighty," "Tammy," "When You Wish Upon A Star," "Fascination" and "Que Sera, Sera"—the latter being particularly well done.

Technically, the disc is excellent, with clean sound and no background noise. The stereo is used purely for breadth, without any attempt at exploiting the separate channels.

★ ★ ★

AL JOLSON, "The World's Greatest Entertainer." Mono, Festival, FL7171.

If you play this disc expecting it to be a mediocre dubbing of earlier issues, you'll be pleasantly surprised. Made up from selections recorded for Jolson's "Kraft Music Hall" broadcasts, the disc fully lives up to its description as "high fidelity." The quality throughout is excellent and the noise level virtually non-existent.

What's more, Jolson sings with plenty of verve, due probably to the fact that he was fronting an enthusiastic audience and backed by orchestra and chorus under Lou Bing.

He introduces his own songs, slips in an occasional quip and works to a back-

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ground of applause in the traditional musical hall manner. And the gravel voice, which so long was his trademark, becomes surprisingly melodic when he sings "Sweet Sixteen" as a straight number.

Other selections include "Alabamy Bound," "My Gal Sal," "Bright Eyes," "Baby Face," "Hello 'Tucky," "I'll Be Seeing You," etc.—actually thirteen in all.

Whether or not Jolson was "the world's greatest entertainer," he certainly had something!

★ ★ ★

"MARCHING DOWN BROADWAY" with The Band Of The Coldstream Guards. Mono, RCA L-10843.

Under the baton of Major Douglas A. Pope, A.R.C.M., P.S.M., a dozen hit tunes from recent Broadway shows are transformed into marching music for a full brass band.

The listener is invited to imagine the band marching down Broadway, beneath a shower of ticker tape, blaring forth tunes from "Oklahoma," "The King And I," "My Fair Lady," "Annie Get Your Gun," "Carousel," and such like.

Whether one would buy the record for the tunes is another matter, however. There's quite a difference in mood between "There's Nothing Like A Dame" as a band item and as I saw it in the film! But, as a demonstration of the band's versatility and musicianship, the record excels.

The recording quality is good, but I wouldn't have a clue about surface noise. With the Coldstream Guards in action noise doesn't stand a chance!

★ ★ ★

JONAH JONES Quartet, "Swingin 'Round The World." Mono, Capitol T—1237.

Jonah Jones has travelled a lot, played a lot and developed, en route, an enviable technique with the trumpet. His production generally is smooth and effortless, but at times he can produce sounds so ragged that, from less of an artist, they would be mistaken for a sustained accident.

Backed, in precise rhythmic fashion, by the remaining members of his quartet, Jones offers tunes from around the world in a manner that will please devotees of the swinging trumpet. Madrid, Shanghai, April in Paris comes in for the treatment, among a dozen numbers.

But, why must star instrumentalists imagine that they also have a duty to "sing"? Jones' vocal efforts are pathetic. He can scarcely find a note, let alone hold it. Without the rhythm to hold them together, such noises wouldn't even pass muster under the bathroom shower.

But that's Jonah Jones.

Technically the disc is right up to standard.

★ ★ ★

"THEY'RE A WEIRD MOB," Nino Culotta, starring John Meillon, with John Bushelle, Max Osbiston, Nigel Lovell, Shiela Sewell. Mono Columbia 330SX-7616.

As a novel, "They're a Weird Mob" took Australia by storm, when it was published in the early 1950s and also ran as a newspaper serial.

As Nino Culotta, the author assumes the character of an Italian journalist-migrant, who arrives in Australia with a good vocabulary of text-book English but with no knowledge at all of Australian slang.

Gradually he merges into the working man's community, marries, builds a house, raises a family, and, we imagine, lives happily ever after.

By its compression into a 45-minute disc, many episodes in the original story have been sacrificed altogether, and the atmosphere of radio serial, microphone and script is plainly evident. But the spirit of the book and its principal characters survives the transformation to become a cameo of Australia's "working-class."

In a sense, this might well be regarded as a companion record to "The Sentimental Bloke," reviewed last month.

A completely Australian production, the disc is technically well up to standard.

★ ★ ★

"SAY IT WITH MUSIC," with Lawrence Welk and his Champagne Music. Stereo, Coral CST-9317T.

Music on this disc is based on a U.S. national television show, presented by the Welk Orchestra.

Thirty or more tunes, which one might describe as "evergreen pops," are woven together into a dozen tracks in dance tempo. What, to my ears, sounds like rather "noisy" music on side 1, gives place to a quieter mood on side 2, so there should be something for differing tastes in music and dancing.

The quality throughout the record is good, the noise level low and the stereo effect normal. (Also available on mono, (CL-7648).

★ ★ ★

"SING IT AGAIN, No. 2," 40 tunes compiled and presented by Johnnie Stewart, by arrangement with the B.C.C. Mono. Columbia 33SX-1187.

The two sides of this record are presumably copies of the B.B.C. sound program, "Sing It Again," broadcast in Britain as a Sunday "tea-time" feature.

It is a light-hearted sing-song, which the audience can listen to or join in—if they can keep track of the rapid changes in title and tempo.

As with most community singing efforts, the songs vary from the traditional to the more modern with "Frere Jacques" and "Yes, We Have No Bananas" alike making an appearance. But that's community singing!

My notes on this one say, "Noise, nil; quality, tons." You can safely give this one to the old folks for their anniversary!

★ ★ ★

"THE MILLS BROS. SING," arranged and conducted by Larry Gordon. Mono, London HAA 7562.

As I listened to this record, I jotted down on the note-pad, "pleasant old-time numbers, sung in traditional Mills Bros. style, with instrumental backing. Noise level, nil; quality, the best."

What more need I say than to list the numbers for your reference?

"Sometimes I'm Happy," "Till We Meet Again," "I'll See You In My Dreams," "Tea For Two," "Solitude," "Star Dust," "Time On My Hands," "September Song," "Autumn Leaves," "Home," "Once In a While," "My Reverie."

"THE GEORGE WRIGHT SOUND," Wurlitzer organ, played by George Wright. Stereo, Hifi-record SR-710.

As an exponent of the cinema organ, George Wright has few equals, either past or present. He combines an unfailing adeptness at the keyboard, with an apparent complete mastery of the multitudinous voices and complexities of the Wurlitzer "one-man orchestra."

Here, again, he plays the organ in the Chicago Paradise Theatre, reputed to be the largest and most elaborate Wurlitzer ever assembled.

The disc is an excellent example of what can be done with such an instrument. It makes train noises for "Honky Tonk Train," it barks for "The Whistler And His Dog," it responds with lightning precision for "Dizzy Fingers."

George Wright is at his best here for these and other cinema organ "classics" and the resulting sound aided by good recording and the stereo presentation.

The one compromising factor is a gentle background of tape hiss, which never quite lets you forget that there's a reproducing system at work.

But this seems to be more a rule than an exception for organ recordings, goodness knows why!

★ ★ ★

"WALTZ ROMANCE": Frank De Vol and his Orchestra. Symphonic arrangements of Favourite Waltzes. Mono, World Record Club, XE1112.

Strictly nostalgic is the music on this disc; music for romance, played in a style easy to listen to by Frank De Vol and his orchestra.

But one word of warning: the varied tempo isn't designed for dancing.

On the disc you'll find the following: "I'll See You Again," "In A Little Spanish Town," "Treasure Waltz," "Wonderful One," "Sari Waltzes," "Shadow Waltz," "One Night Of Love," "Jeannine," "Thousand And One Nights," "Parlez-Moi d'Amour," "Three O'clock In The Morning," "Gold And Silver Waltz."

Recording quality? Right up to standard!

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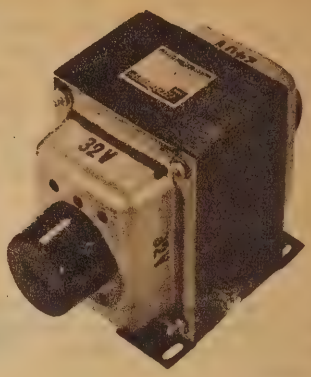

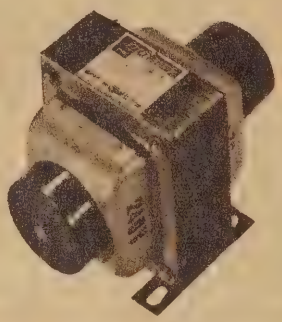

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IN REVIEW—By JULIAN RUSSELL

EXCELLENT RECITAL BY SOUZAY

SONGS OF MANY LANDS. Recital by Gerard Souzay, baritone. Mein Madel hat einen Rosenmund (arr. Brahms), Volkslied (Mendelssohn), Jagerlieben (arr. Dorumsgaard), Om Dagen mitt Arbete (arr. Dorumsgaard), Til Norge (Paulsen-Grieg), Une Pedriole (arr. Vuillermoz), L'Amour de Moy (arr. Dorumsgaard), Bourree de Chapdes-Beaufort (arr. Dorumsgaard), Preletel Slavicek (arr. Dorumsgaard), Savishna (Moussorgsky), Karjalan Kunnailla (arr. Dorumsgaard), Tunturille (Kilpinen), La Barcheta (Buratti), She Moved Through the Fair (arr. Dorumsgaard), The Stuttering Lovers (arr. Hughes), I'm Goin' Away (ar. Dorumsgaard), Cancao do Careiro (Villa Lobes), Azualao (Oballe), Sai Arne (Guarnieri), Triste (Ginastera), Pano Murciano (arr. Nin), Granadina (arr. Nin). Piano accompaniment by Dalton Baldwin. HMV Mono OALP 1709.

The songs, as the titles indicate, come from Germany, Sweden, Norway, Canada, France, Czechoslovakia, Russia, Finland, Italy, Ireland, America, Brazil and Spain. The titles will also indicate their unfamiliarity to most discophiles. Souzay sings them all with exquisite taste in a voice that is beautifully even throughout its range and completely responsive to the subtle inflections he imposes on it.

They are all given in their original tongue and, though no word-for-word translation of the text is enclosed, a resume of the subject matter makes it easy, in every instance, to follow the meaning.

Savishna (Moussorgsky) does not reach the same high standard of excellence as the others. It lacks both humour, emphasising rather its pathetic subject, and the strong characterisation that illuminates the others. But this is the only blemish on a disc that I can recommend as a connoisseur's buy to anyone interested in enchanting, if never showy, singing.

★ ★ ★

Mahler—Song of the Earth. Symphonic setting of songs from the Chinese. Played by the South-West German Radio Orchestra with Grace Hoffman (soprano) and Helmut Melchert (tenor). Conducted by Hans Rosbaud. Vox Stereo STPL 510912/1/2.

The best feature of this recording is the transparency of the orchestral texture which can sound, under some conductors, horribly thick and turgid. Rosbaud also, while not offering too matter-of-fact an interpretation, keeps the work's romantic flavour well on the right side of sentimentality.

He achieves this by insisting on a full, vibrant, but never too opulent tone from his strings. The result is bright rather than rich. The wind and brass attack and release cleanly, especially in the difficult passages in the third movement. The vocalists, however, are not so successful.

The tenor strains to reach his top notes with an unpleasant result in the frenzied Drinking Song which opens the work. And Kathleen Ferrier years ago recorded such a peerless performance of the contralto part that an inevitable comparison with the soloist here is much to Madame Hoffman's disadvantage. Unsteadiness of tone and lack of weight are her chief handicaps. The stereo distribution is fine.

★ ★ ★

SADLER'S WELLS FESTIVAL OF BALLET. Comus Overture (Purcell arr. Lambert), Prospect Before Us—Fugue in D Major (Boyce arr. Lambert), Harlequin in the Street—Allegro (No. 10) (Couperin arr. Jacob), Lord of Burleigh—Agitato (No. 5) and Allegro Vivace (No. 6) (Mendelssohn, orch. Jacob), Les Rendezvous—Allegro non Troppo (No. 5) and Allegro (No. 60) (Auber arr. Lambert), The Rake's Progress—Sarabande and Orgy (Gavin Gordon), Apparitions—Consolation (No. 1) and Galop (No. 7) (Liszt, orch. Jacob), Horoscope—Valse for the Gemini (No. 3) (Lambert), Wedding Bouquet—Tango and Waltz (Stein-Berners), Adam Zero—Dance of Summer (No. 10) Bliss, Cinderella—Waltz and Midnight (No. 38) (Prokofieff). Played by the Royal Opera House Orchestra, Covent Garden, conducted by Robert Irving. WRC Mono XE1109.

Here is a fine collection of off-beat items most of which will be unfamiliar to balletomanes in Australia. I can't remember any of the ballets featured here having been danced in Australia, at any rate, by a professional company. Indeed, many of them have now been deleted from the Sadler's Wells repertoire.

All are brief and none without interest to the music scholar, while many should have a wider appeal. Most are arrangements. One of the original compositions, The Rake's Progress by Gavin Gordon, consist of a sad little Sarabande and a bustling, though never very unbuttoned, Orgy, in which the broken rhythms are neatly pointed. Much of the material in this item is commonplace, perhaps deliberately so. You never know nowadays.

The Mendelssohn number, Lord of Burleigh, is very graceful indeed, and you will hear some nice staccato in Auber's Les Rendezvous, arranged by Lambert, who was for many years, before his untimely death, a leading figure in the Sadler's Wells organisation.

The sugary little Liszt tune arranged by Jacob adds variety to the otherwise more sophisticated selection. It is followed by a most un-Lisztian galop. Lambert's charming little waltz in Horoscope is a bit glum despite its suggestion of happier things.

In the Berners piece a chorus is added to a score as smart as the latest issue of "Vogue," though it lacks the wit of the composer's earlier ballet, "The Triumph of Neptune." Bliss' Adam Zero is a very contrived trifle.

Gerard Souzay

After these "petits maitres" Prokofieff might have been expected to sound rather more impressive than he does here. But he merely uses his customary expertise to say nothing very much as gracefully as possible.

★ ★ ★

Marche. Entry of the Gladiators (Fucik arr. Arnaud), Conquest (Newman), Zacatecas (Codina arr. Arnaud), Rakoczy March (Berlioz), Turkish March (Beethoven), Stars and Stripes for Ever (Sousa arr. Arnaud), March from The Love of Three Oranges (Prokofieff), Marche Militaire (Schubert ar. Arnaud), Procession of Bacchus from Sylvia (Delibes), Parade of the Wooden Soldiers (Jessel arr. Arnaud). Played by the Hollywood Bowl Symphony Orchestra conducted by Alfred Newman. Capitol Stereo SP-8479.

The Entry of the Gladiators, the tune that invariably introduces acrobats in a vaudeville show, goes here at a much more stately pace than you'll hear it in the theatre. Conquest is pretentiously dull. Zacatecas, described in the sleeve notes as "suggestive" is just a commonplace march tune in the vein of "Distant Greetings" and "With Sword and Lance." The Rakoczy March is uninspiring.

All these you will find on the first side and there may be better items on the reverse. But I found one side enough. The stereo is spectacularly efficient.

The production is described with customary American lack of modesty as featuring "dynamic symphonic interpretations of march music in all its colour, excitement and variety." And why add an "e" to the end of the far from disreputable English word in the title?

★ ★ ★

Offenbach — Gaite Parisienne. Bizet—Carmen Highlights. Played by Andre Kostelanetz and his Orchestra. Coronet Mono KLL 1616.

The opening of Gaite Parisienne goes so fast that I thought my machine was playing at the wrong speed. And this ludicrous scramble is very shrill and deplorably vulgar. Distressingly, it is obviously played this way by splendid

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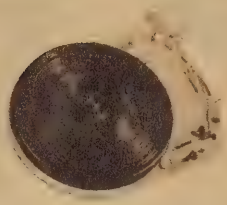

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nusicians. It all evokes a picture of a ›and of brightly feathered macaws.

The same tawdry sound and playing ›an be heard in the Carmen selection ›n the reverse. The whole is enclosed n a revolting cover of chocolate-box lesign.

★ ★ ★

Berlioz—Symphonie Fantastique. Played by the Philharmonia Orchestra conducted by Herbert von Karajan. WRC Mono TE 215.

The sound is good but the woodwinds ›ccasionally too prominent in bars vhere their contribution is unimportant. Elsewhere the horns bring up parts eldom given prominence. Otherwise, lthough the recording was made over ive years ago, the engineering is as ;ood, and even better, than some more ecent examples. The dynamic range s very wide, so that f you start the ›pening pianissimo t too strong a volume you will have o reduce it later for he tutti fortissimos.

There is no lack of "devil" in Karajan's reading, hough, surprisingly, for him, he tends to ›rettify the line of the main theme. The "March to the Gallows" is ery vivid and dramatic, and the "Walpurgis Night" movement truly nacabre. Perhaps the bell, just off ›itch, might make it sound even more o to sensitive ears. The drums at the nd of the slow movement are carefully estrained from overstating the storm ffect.

This is not my favourite "Fantasique," I think Beecham's and Markeitch's much superior. There is a strong int of a foreign accent in Karajan's resentation of this essentially French nusic. But it is certainly excellent value t the low price it is offered at.

★ ★ ★

Belafonte at Carnegie Hall. Recital by Negro singer divided into three parts, Moods of the American Negro, In the Caribbean, and Round the World. With orchestra conducted by Robert Corman. RCA Stereo SLB 10815/1/2.

Vocally, of course, Belafonte is no Robeson. His voice is eminently pleasnt and expressive though without veight, and made attractive, to this listner, at least, by a buzz on its edge. His interpretations are always eloquent nd on this set he sometimes punctuates is items with penetrating remarks.

"What could be more festive than a uneral?" he asks, for instance, talking f an old-time Negro funeral in New Orleans.

The recital was recorded live with utstanding success last April at Caregie Hall, New York. On the evidence f these two 12-inch discs, Belafonte has ncreased in stature to become one of he most impressive popular artists of his decade. He carries the whole of he long entertainment on his shoulders vith great aplomb.

He identifies himself completely with vhatever he is singing — Negro spirituals and gospel hymns, calypsos, and n the last part of his recital, songs from France, Israel, Ireland, and Mexico. He finishes on an audience-participation note using successfully all the tricks of "getting 'em in."

This last is based on "Matilda," a little song in shape not unlike "Open the door, Richard" that was popular during the war years. He builds up enthusiasm skilfully, his audience's shyness departing as humour enters. The voices grow in volume at each repeat—and so does the applause between. The tune, simple enough to be remembered even by the tone-deaf, goes on over and over again, till it finishes with, one imagines, every throat in the packed hall adding its quota to the exhilarating din.

The accompaniments, all of them superbly played, vary in instrumentation from a 47-piece symphony orchestra to whispered undercurrents coming from drums and guitar. And the stereophonic spread, depth and richness is as fine as any I've heard.

★ ★ ★

Tchaikowsky — 1812 Overture. In the Steppes of Central Asia (Borodin), Polovtsian Dance (Borodin), and Night on Bald Mountain (Moussorgsky). Played by the Philadelphia Orchestra conducted by Eugene Ormandy. Coronet Stereo KLCS 2713, Mono KLC 2713.

Tchaikowsky — 1812 Overture. Hungarian March (Berlioz), Hungarian Rhapsody No. 2 (Liszt), Valse Triste (Sibelius), and Invitation to the Dance (Weber orch. Berlioz). Played by the Philharmonia Orchestra conducted by Herbert von Karajan. Columbia Mono 33CX 1571.

Tchaikowsky — 1812 Overture. Bolero (Ravel). Played by the Morton Gould Orchestra and Band conducted by Morton Gould. RCA Mono L16218.

Coronet's stereo provides much the best sound on these four discs, though the best mono engineering is RCA's. If, however, you do not own stereo equipment your preference will probably be influenced by the couplings or by the very different interpretations of the main item by the three conductors.

Both Ormandy and Gould belong to the ultra-demonstrative American school which gives full rein to the orchestral soloists' desire for self-advertisement while extracting the very last drain of "schmaltz" and drama from the score. Here Gould is even more exuberantly emotional than Ormandy, and his guns and bells raise a great clamour in the Finale.

Karajan is more restrained but only, one feels here, because he is not quite so expert at this sort of thing as his American rivals. Indeed, in the Liszt Rhapsody Karajan goes all out after the "molto expressivo" style of the other two. But he balances this by an extremely graceful account of the Weber, and a brilliant Hungarian March.

Ormandy's couplings all demonstrate the wonderful virtuosity of his players, their luscious string tone, massive yet never strident brass, and woodwind who offer what, to most other conductors — except perhaps Leonard Bernstein — would be more than is expected of them.

RCA's disc has shorter playing-time than the other two labels, with Ravel's single composition on its reverse. This is given a conventional performance except for the exaggerated inflections noticed earlier.

★ ★ ★

Pour La Harpe. Music of French Origin transcribed for harp. Played by Marcel Grandjany. Capitol Mono P8401.

For harpists this should be a "must." Other discerning musicians will appreciate the great skill and good taste of M. Grandjany, but perhaps in rather smaller doses than are offered here.

Despite a technique that enables him to extend widely his instrument's usually very limited emotional range, M. Grandjany is often handicapped by this transfer to his own from other, more expressive mediums. Yet what he succeeds in achieving is very impressive indeed.

His harp has quite wonderful sustaining power, his ornamentation comes at crisply as if from a harpsichord, and he manages true crescendos and diminuendos.

The sound is absolutely faithful and is mercifully free from the noises of moving pedals that so often mar harp discs.

His program consists mostly of transcriptions of piano and harpsichord pieces by Debussy, Daquin, Rameau, Ravel, Couperin, and Perilhou, to which are added three French folk songs — 13 items in all.

★ ★ ★

Walton — Selection from Facade Suite. Lecocq — Selection from the opera La Fille de Madame Angot. Played by the Royal Opera House Orchestra, Covent Garden, conducted by Anatole Fistoulari. RCA Mono L16215.

Facade has often been recorded much more wittily than you'll hear it played here. Most of the musical jokes are ponderously underlined and the excellent quality of the engineering makes the lack of humour in the playing even more apparent. Mamzelle Angot is much merrier since gaiety and not irony is called for here.

★ ★ ★

Beethoven—Concerto No. 5 in E Flat (The Emperor). Played by Mindru Katz and the Halle Orchestra conducted by Sir John Barbirolli. Pye Stereo SPLC 5004, Mono PLC 5004.

This Rumanian pianist, a newcomer to recorded music, is another of those brilliant young men equipped with a technique that, years ago, would have raised the eyebrows of Franz Liszt himself. But Katz has, too, an intellectual maturity that few of his astonishingly dextrous contemporaries can match.

I base this observation on the evidence of his essentially solid reading of this exacting concerto. The virtuoso display is confined to the cadenzas, elsewhere the performance is carefully considered and persuasively delivered.

Barbirolli and the Halle support him with an exemplary accompaniment. In the mono version the balance favours the soloist to a degree that sometimes results in the orchestra being pushed too far into the background. But this is corrected in the stereo which I can recommend with the greatest enthusiasm to those on the look out for a recording of this concerto.

★ ★ ★

Janacek—Sinfonietta for Orchestra. Prelude to Act 1 of The Makropulos Affair. Prelude to Katya Kabanova. Prelude to The House of

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the Dead. Prelude to Jealousy (Jenufa). Played by the Pro Arte Orchestra conducted by Charles Mackerras. Pye Mono PLC 5013.

It is now some six years since I hailed ith delight in my weekly column in he Sun" the early Supraphon LPs of nacek's music. Nowadays it has won ch popularity in England that the eras Jenufa and Katya Kabanova fill ovent Garden.

Charles Mackerras achieved a notable ccess when he conducted the latter in ndon last year. In his presentation the Prelude on this disc he displays l the appreciation of its emotional mplexities that earned him such great aise overseas.

With it is the Prelude to the House the Dead, a black work based on ostoevsky's novel about his experi-ces in a Siberian prison camp. This onderful piece of dark imagery has ntil now only been obtainable in Aus-alia on the Philips complete recording the opera, long deleted from their talogue here and abroad.

With it goes, too, the Prelude to an-her Janacek opera, The Makropulos ffair, and the discarded overture to enufa, both thrillingly played.

The reverse is devoted to the Sin-nietta, Janacek's last work for orches-a. Mackerras' youthful delight in mas-ve, brilliant sound, which he displayed his recent tour of Australia and in s recent recording of Handel's Royal ireworks Music in its original form for ultiple wind and brass instruments, is epeated here when 12 trumpets com-ne to deliver the final fanfares.

Pye's engineering has served him well this outstanding example of modern mono reproduction. Played on stereo equipment the sound, despite its weight, has excellent transparency. Those who have already met this great Czech composer will need no urging from me to hasten to acquire this authoritative disc. Those who haven't will find on it one of the most original statements of real music to be made during the past 50 years.

★ ★ ★

The United Nations Singers — Folk songs from around the world. Under the direction of Donald Read. Coral Stereo CST-9316T, Mono CL-7647.

The United Nations Singers, to quote the record sleeve, ". . . is a recreation club, its membership open to the UN Secretariat staff, affiliated delegations, and their respective families . . . The voices . . . belong to bilingual secretaries, translators, messengers, photographers, painters, accountants, editors, librarians, clerks and administrators."

Not surprisingly, bearing in mind the multi-racial components of the choir, the songs, which indeed come from all over the world, are sung in their original languages. China, Chile, Sweden, France, Germany, Russia, England, America, Austria, Norway, Nigeria, Italy and Finland are all represented. In all there are 18 ditties, all of them brief.

The choir sings reasonably well considering the fact that choice of members is limited, though a little more spirit would have been welcome in the brighter items. The stereo version is to be preferred if you have the equipment to play it. If you haven't, the mono is quite acceptable.

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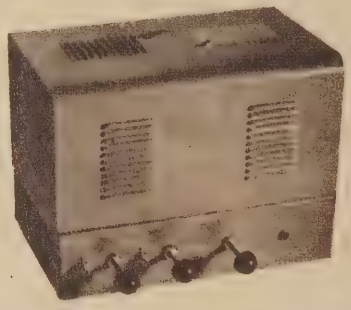

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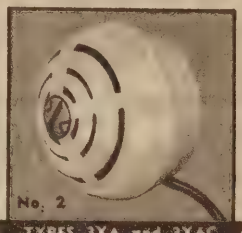
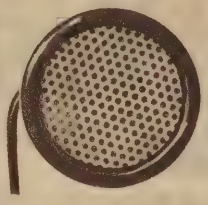


No. 2

TYPES 3XA and 3XAC CRYSTAL

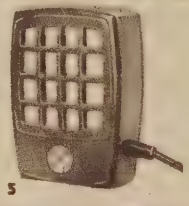


No. 3

"12XAB" CRYSTAL

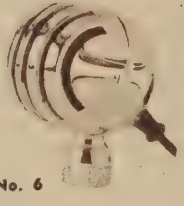
No. 4

"8XA" CRYSTAL



No. 5

"4XA" CRYSTAL



No. 6

"10XA" CRYSTAL

No. 7

"5XA" CRYSTAL

No. 8

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THE SERVICEMAN WHO TELLS

(Continued from Page 53)

such failures, leaving the whole problem nicely up in the air. All that emerged from the discussions were some general facts, interesting enough in themselves, but not having any direct bearing on the problem.

Fairly obviously, the output stage is the hardest working stage in the set and, if the set as a whole is subject to some form of abuse, it would be reasonable to expect that the transistors in this stage would be the first to fail.

The most likely abuse is heat, transistors being very heat-sensitive devices. For this reason a well-designed output stage will have certain protective features aimed at maintaining correct operating conditions over a wide range of ambient temperatures.

THERMISTOR

One of these is usually a heat sensitive resistor (thermistor) forming part of the base bias network, and so arranged that an increase in ambient temperature — which would tend to increase the collector current — will decrease the base bias and thus keep dissipation within safe limits.

One point I learned was that some of the early imported transistor sets lacked such protective circuits, resulting in an epidemic of failures with the first bout of hot weather. Fairly obviously, they were designed for a more temperate climate than ours. Apart from these, all current designs appear to provide such protection as a matter of course.

Another protective measure is the inclusion of a small amount of resistance, something between one and five ohms, between the emitter and chassis in the conventional common emitter circuit. Although still concerned with heat, this has a somewhat different function.

If such an output stage is overdriven, by trying to get more output from it than it was designed to give, the temperature of the transistors themselves may rise to a dangerous level. This causes more collector current to flow, more heat to be generated, and so on, producing the classic "run away" condition which will eventually destroy the transistors.

SIMILAR CASES

The only cases I was able to find similar to those I had encountered were related to me by one of the transistor manufacturers. In each case they had been able to examine the complete set and trace its history prior to the failure.

In one case the set had been left in a completely closed car parked for several hours in the blazing sun during one of last summer's "sizzlers." When the owner returned to the car he switched the set on immediately, and the output stages failed shortly after. This appears to be an extreme case where not even the protective circuitry was able to cope with the situation.

The other failure was due to a quite different cause. A serviceman had been testing the output stage by feeding an audio generator into it. For some reason he elected to use a 10 Kc signal, and a pretty solid one at that. This may sound harmless enough, but the transistors failed in short order.

The reason for this is rather unusual. It is common practice to fit a capacitor of about .1 mfd across the primary of the output transformer to serve as a top cut filter and aimed mainly at the high frequency components produced by "cross over" distortion, a characteristic of all class B systems, and transistor systems in particular.

At 10 Kc this capacitor has an impedance comparable with the normal load into which the transistors are working. If we plot a new load line on the transistor characteristic curves, on the basis of the reduced load, it is almost certain that it will overlap the maximum dissipation curve for a considerable portion of its length. Add an over-driven condition and the transistors will be badly over rated, and must eventually fail.

As I said at the beginning, all this is very interesting general background and I have seen fit to write about it for that reason. But it does very little to solve the problem of three similar failures on the one work bench in a period of a few weeks.

Was it mere coincidence, or is it indicative of average conditions?

And if the latter, why; and what is the solution?

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EU, EUT, EUL (High efficiency erase) £5/7/

H4 (Record-play) and EH4 (Erase) Miniatures .0002in gap £5/2/

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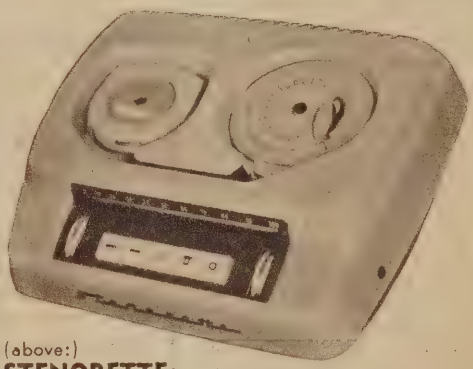

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AMATEUR BANDS WITH BILL MOORE

VIGOROUS GROWTH OF HAM RADIO IN 25 YEARS

During the past 25 years the Amateur Service has greatly advanced in technical know-how and number. The growth, about sevenfold, has been world wide, with the greatest increase in the U.S. An indication of the changes can be obtained from Press reviews of the period.

SOME idea of the happenings in Amateur Radio during 1935 can be leaned from news published in the ournal "Wireless Weekly." A compari-on provides an indication of the tre-endous growth in the Amateur Service uring the intervening 25 years.

The International Amateur Radio Union then showed a membership of 6 International Amateur Radio Societies hose members totalled 36,000.

PRELUDE TO CAIRO

The Union was invited to send two elegates to the 1937 meeting of the nternational Technical Consulting Com-ittee on Radio Communication to be eld at Bucharest. Arrangements were lso being made to ensure effective repre-entation at the I.T.U. Cairo Conference o be held a year later. The main aim t this conference was to press for an xtension of the 7 mc/s band to include 000 to 7500 kc/s, to relieve some of ne congestion prevalent on this allo-ation.

The frequency bands available to mateurs in Australia at the period were 700 kc/s to 2000 kc/s, 3500 kc/s to 000 kc/s, 7000 kc/s to 7300 kc/s, 14000 kc/s to 14400 kc/s, 28 mc/s to 30 mc/s and 56 mc/s to 60 mc/s. The power input to the final valve was restricted to a maximum of 25 watts and the licence fee thirty shillings. There were no limits on Morse and CW operation and music could be transmitted on the bands available.

It was during this year that the first contacts were made on the 28 mc/s band between Australia and Europe. Early in the year, contacts with the U.S. became commonplace, with Arch Cox VK2EP (now VK1GU) and Con Bischoff VK2LZ among the leading stations in this work. It was VK4EI who was to contact the first European when, on October 5, he QSO'ed ON4AU. This was followed within the next 24 hours by VK2LZ, VK4BB and VK2HZ breaking through.

The first working with the U.K. was made by VK2LZ on October 6, when G6LK provided the signal from that country. Much DX activity at that period was centred on 28 mc/s and the band was gradually opened for world-wide contacts in a similar manner to the opening of the 50 mc/s band in the 1950s.

Later in the year Nell Corry, G2YL, our recent visitor, made a W.A.C. in only six hours, a notable achievement for those days.

It was interesting to note that the development of the 28 mc/s band for world-wide DX occurred during a sun-spot minima.

Ray Jones, VK3RJ, during the year was appointed the W.I.A.'s Federal QSL officer, a position he still holds.

There was activity, too, on the VHF bands, mainly on 5 metres, with the then radio scribes Don Knock, VK2NO, and the late John Moyle, VK2JU, supplying many of the ideas.

Mobile operation, field days and plane to ground working were all popular.

It was a revival of the original work on 5 metres, here first carried out in 1927. Acorn valves made their appearance about this time and they greatly assisted VHF design of receiving equipment.

SILVER JUBILEE

During 1935 the N.S.W. division celebrated its Silver Jubilee as the oldest Amateur Radio Body in the world. It was originally formed three years before the R.S.G.B. and four years before the A.R.R.L. The year was 1910.

Newcastle Ham Fests were then the rage, conducted by the Newcastle Amateur Radio Club.

Seventy amateurs attended the event that year. Incidentally, the Morse Test for the contest was sent by Allan Fairhall, MHR, VK2KB.

After the Federal Convention held in Hobart in 1935, Federal headquarters was moved to Sydney for two years, the N.S.W. division supplying the members of the Federal Executive. F.H.Q. had previously been located in Adelaide for a similar period.

During the year the gramophone companies decided that amateur stations playing records were infringing copyright.

ROYALTIES

They were providing public entertainment without paying a royalty fee. The companies approached both the P.M.G.'s Department and the W.I.A. on the matter. Fortunately, the case resolved itself without any problems and amateurs continued on their way without change. Later, the permission to transmit music was withdrawn.

Equipment at the time was simple by present-day standards. Most amateurs used crystal controlled transmitters, the VFO being yet to come. Receivers were often a screen grid detector and an audio stage.

BAND CUTS — P.M.G.'S DECISION

IN May, further questions were directed to the Postmaster-General in Federal Houses on the subject of proposed cuts to Radio Amateur frequency allocations. Mr Allan Fairhall, M.H.R., VK2KB, made a number of pertinent points in a speech during a sitting of the House of Representatives.

He compared specific Australian and American Radio Channel requirements and queried the reasons for the cut in view of far greater demand for channels in the U.S. Mr Fairhall also pointed out the greater band widths available to U.S. amateurs.

He questioned too the action taken in view of the undertaking given members of both Federal Houses that no changes would be made unless it was in accordance with general Geneva decisions and referred to the 3.5 mc/s band specifically. Subsequent letters to members and radio amateurs from the Postmaster-General seem to indicate that the undertaking referred only to the 14 mc/s band — news to most persons concerned. In N.S.W., TV publicity was afforded the State president, Ted Whitting, VK2ACD, and Press publicity for Federal Councillor, Dave Duff, VK2EO. Amateur radio and the I.T.U. Conference decisions were discussed.

The many complaints offered on the Geneva allocations apparently bore some fruit as, in late May, the Postmaster-General in a Press release announced that the Government had decided to set up a special committee to review and study the Geneva Conference Allocation Table.

It is intended that the committee will have wide representation and operate under an independent chairman not drawn from any Government department.

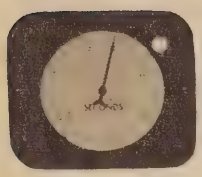
Members will be representatives from the Armed Services, scientific bodies, commercial users, Australian Broadcasting Board, the P.M.G.'s Department, radio amateurs and the like.

They will survey the whole frequency allocation table and report back to the Postmaster-General for submission to Cabinet. It appears for the moment and for many months any decisions re amateur allocations will be in abeyance until the committee sits.

It is hoped the action of appointing a special committee will ensure the case of the radio amateur will be effectively put and not finally shelved in the mass of technicalities that invariably arise from any deliberations of this type.

TIME

GENTLEMEN



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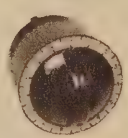

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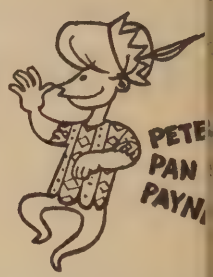

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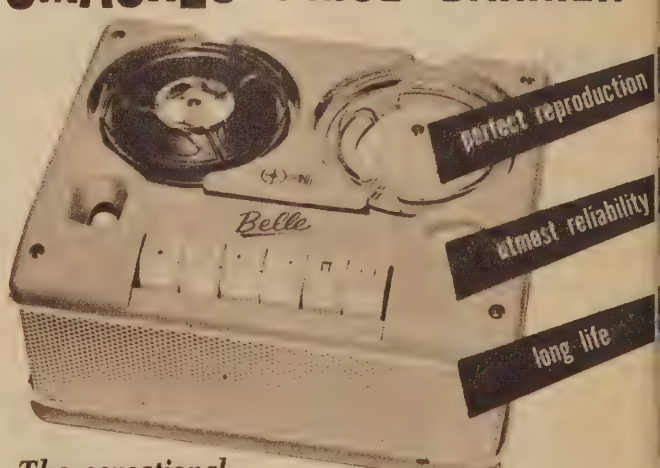

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W.I.A. in N.S.W.

HE N.S.W. Division of the W.I.A. is calling for assistance for their two jor projects, VK2WI Dural and the ministration H.Q. at Crow's Nest. At ıral much work has been in progress luding a major cleaning-up process excess scrub and a power line has en run from the emergency power it to main station building.

There is plenty of work to be done both centres and any assistance would greatly appreciated. Persons willing to p should follow the broadcast appeals er VK2WI, or contact the secretary, rm Beard, VK2ALJ, at 13 Atcheson eet, Crow's Nest.

Major Collett, VK2RU, president of Gosford Radio Club, Central Coast ction of the W.I.A., was elected a member of the N.S.W. Division for vices rendered to the Institute and ateurs generally, at a special meeting May. Major, an active amateur for er 25 years has always operated from und Brisbane Waters and was first ird using battery-powered equipment m an orange orchard at Lisarow out m Gosford.

Always a keen VHF enthusiast, he s one of the first to appreciate the ssibilities of JA to VK working on 50 mcs band. Back in 1956 he was first VK2 to contact the JA, and nsistently monitored commercials ound 50mcs in order to check on pos- le openings.

Amateurs throughout the State con- atulate Major on his elevation to life embership of the W.I.A.

Lecturer at the May meeting of the S.W. division held at Science House, s Barry Goodman, VK2ZAG, who ok as his subject the behaviour of mponents at VHF. The lecture was ry informative and samples of suitable uipment were on display.

At this meeting a motion was carried at a plaque be erected at VK2WI, ıral, commemorating the official open- held in 1957.

The appeal to members for their spare 0TH's and 866's was successful.

Council appreciates the support of embers in this matter. An appeal has o been made for a licensed electrical ntractor to carry out work on exten- ons in the station building.

Field day

HE N.S.W. VHF and TV section of the WIA Autumn Field Day held May provided much activity of in- est to the VHF fraternity. Ten mobile ations were in the field, located at rious vantage points within a 100-mile dius of Sydney. Mobiles active in- uded VK2ZCF, 2ASZ, 2OA, 1ZBX, W, 2HL, 2ZVL, 2ZAG, 2ZKP, 3ZCN. cluding home stations some 50 stations re active and results of the contest re as follows:—

Point scores

1st—VK2ZKP located at the Gib, wral, 2,270 points.
2nd—VK2ASZ at Bell, 2,145 points.
3rd—VK2OA at Hassans Walls, Lith- w, 2,096 points.
Home stations:
1st—VK2AZW 1,017 points, 2nd—K2ZPG 786 points and 3rd—VK2ZDP 6 points.

The May Evening Field Event of the ction saw the fox VK2AWZ located Picnic Point. The winner was K2ZBX who arrived in 30 minutes, 2nd VK2RX 43 minutes and 3rd VK2ZVL 1 hour 9 minutes.

The Section's next major field event is the mid-winter contest to be held on July 16 and 17.

Operation will be on the 50 Mc/s band and above. Full details will be provided via VK2WI and Bulletins.

Section meetings

LECTURES presented in May included a discourse by Barry Goodman, VK2ZAG, and Bob Winch, VK2OA, on VHF subjects to the Hunter Branch of the WIA. Dick Meerstadt, VK2RM, discussed ceramic condensers and their manufacture at the Blue Mountains Section Meeting. Mr John Briar at the Central Coast Section's Meeting described the technical problems of an electrical undertaking.

The meeting night of the SWL Section of the WIA N.S.W. Division has been changed from the 3rd to the 2nd Friday of each month. The venue is still 14 Atcheson Street, Crow's Nest. Office Bearers for the year are as follows:—President, Phil Irvine WIA L2155, vice-presidents, Barney Smith WIA L2001, Allen Chatto WIA L2185, secretary, Gerry Albeck L2011, assistant secretary, Ron Smith L2003, QSL and publicity officer, Reg Wood L2057, H.Q. delegate, Joe Pollock L2156, Dural delegate, Maurice Gascoine L2083.

Members are still required for the Young and District Radio Club. 14 enthusiasts have indicated interest in the A.O.C.P. morse and theory classes. Meetings are held at the Royce Potter radio workshops, Young. Interested persons should contact VK2VT, 3 Margaret Street, Young or VK2APP, Stoneridge, Monteagle.

Sunspot report

MORE information is coming to hand from overseas providing an evaluation of the last sunspot maxima and what it provided in the way of 50mc DX. A fair yardstick is trans-Atlantic working. Solar cycle No. 18 provided openings for such work on two successive years 1946 and 1947.

Solar cycle No 19, now declining, provided trans-Atlantic working in 1956, 1957-58, 1958-59 and again in 1960. The passage of time has naturally provided improvements in equipment and listening techniques, too, may have made some slight difference to the observations.

DX code

THE ARRL's DX operating code provides some valuable pointers for potential DX operators.

The ARRL recommends—Calling DX only after he calls CQ, QRZ? or signs SK. Not calling when he sends KN, AR or CL or on his frequency.

Not calling because you heard someone else calling him or sending a CQ DX in the hope he may answer.

Observe the calling instructions of DX stations IOU, 15D, etc.

An important one:— Avoid asking a rare DX station to listen out for a friend. Let the friend take his chance with the rest. Also avoid engaging a rare DX station in rag-chews. Possibly nearly half the world is standing by waiting to contact him. How much easier it would be if the above points were strictly observed.

(Continued on Page 98)

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AMATEUR BANDS

(Continued from Page 97)

Operation "Steam-roller"

THE R.S.G.B. describes the extension of the U.S. telephony allocation up to 14,350 kcs as "Operation Steam-roller." The society is particularly critical of the A.R.R.L. in an editorial in their bulletin and sums up the position with the statement that apparently the interests of other amateurs (outside the U.S.) are of no consequence.

The following is an extract from the editorial, "On the face of it, the changes are entirely a domestic matter for U.S. amateur radio: there would, of course, be no case for American amateurs being subject to special restrictions such as compulsory band planning, if they operated on an equal footing with most of the rest of the world. But the plain fact is that they do not. Particularly is this so in relation to power.

"It would certainly have made the pill a little easier to swallow if, at the time the A.R.R.L. had made its request for an extension of the phone band, it had also asked for some form of power limitation more in keeping with international amateur radio than international broadcasting.

"As it is, the way this matter of world-wide importance has been handled bears the stamp of 'steam-rollering' in complete disregard of amateurs in other countries. Canadian amateurs are particularly incensed by the changes and are in fact petitioning their licensing authority (the Dept. of Transport) to give them the same general phone bands as those in other Commonwealth countries."

The most affected section of overseas operators were the S.S.B. users and a number of suggestions have been made as to a spot where they can congregate.

The R.S.G.B. is supporting a suggestion by G2BVN that the S.S.B. gang use from 14,100 to 14,125 kcs and a number of them agree with the idea. Wherever they finish it will be a squeeze and someone will complain.

Abbreviations

IT may not be common knowledge that our abbreviation 73—best regards, has been in use for over 100 years. It was one of 92 expressions worked out by the Telegraph people in 1859 who were trying to save time on their lines. Most of the other figure combinations have fallen into disuse. "73" is used many thousand times a day in the amateur service. Some of the other abbreviations in common use mainly on morse, are as follows:

ABT—about, AGN—again, BK—break-in, B4—before, CL—closing down, CUD—could, CUL—see you later, FB—fine business, excellent, GA—go ahead, GB—goodbye, GE—good evening, GM—good morning, HI—telegraphic laugh, high, HR—here, hear HW—how, LID—poor operator, MSG—message, ND—nothing doing, NR—number, NW—now, OB—old boy, OM—old man, OT—old timer, PSE—please, PWR—power, R—received a transmitted, RPT—repeat, SIG—signal SRI—sorry, TFC—traffic, TNX—thanks, TU—thank you, URS—yours VY—very, WL—will, WUD—would WX—weather, YF and XYL—wife, YL—young lady, 73—best regards, 88—love and kisses.

ON SHORTWAVE BY ART CUSHEN

ENGLISH SESSIONS FROM TGJA

Reception of the Central and South American signals from early afternoon and again later at night, provides interesting listening in the 49 and 60 metre bands.

THE Guatemalan signals, which are best received, include the signals from TGJA, which has initiated yet another English session on 5995 Kc. The transmissions from 2.30 to 3.00 p.m. consist of news about Guatemala in both English and Spanish, and marimba music is included in the program. The new session gives vivid accounts of the tourist possibilities of Guatemala, and reports should be made to the sponsors, Guatemalan National Airways, Guatemala. Postcards are being sent to acknowledge the reports. TQGA in Guatemala reported on 11700 Kc. has now been heard to sign off at 2.05 p.m.

Peruvian signals, which are well received, include the Radio America Lima signals on 6000 Kc. to sign off at 4.00 p.m.

The familiar V sign is used by Radio Victoria in Lima, which has dropped in frequency to 5840 Kc. Signals are strong and the station has a news bulletin at 2.45 p.m. before closing.

Honduras, the little heard country on shortwave at the moment, provides very strong signals on HRN using 5870 Kc. The station gives its call frequently, when closing at 3.00 p.m., and uses a good-night theme to sign off its transmission. The station has also been heard at 9 p.m. and at this time too, signals are very strong.

Peru's Radio National in Lima has several new transmissions in English carried on OAX4T using 15160 Kc. Transmissions include English on Friday from noon to 12.30 p.m., Tuesdays, Thursdays and Saturdays from 7.00 to 7.15 a.m., and on Wednesdays from 8.15 to 8.30 a.m. Colombian Station Radio Sol, in Cali, has now been heard on regular transmissions and signs off at 3.00 p.m. on 6118 Kc.

New Transmitters

NEWS on the installation of new high-powered transmitters in Cuba and Ghama has been announced. The Cuban station will be constructed to serve an international audience. Ghana has signed a contract with Marconi Wireless of England to install 4 new 100 Kw transmitters at Tema, near Accra, and also will have 22 directional antennas. Ethiopia is to have a new Lutheran station and £160,000 has been pledged for a new station.

Chilean Disaster

CHILEAN stations have been heard in round-the-clock broadcasts following the recent earthquakes. Radio Minería has been noted on the new frequency of 6070 Kc. closing at 3.00 p.m., but all night at the time of the disaster. strong signals from a relatively new Chilean station have been heard in the afternoons and during the earthquake period, throughout the night. CE610 Kc. is scheduled to use 6100 Kc., but at times drifts as low as 6095 Kc. At 3 p.m. the signal is often mixed with Munich, with VOA programs on the 6100 Kc. channel. During the late evening programs the CE610 station relays the broadcasts of CE607 Radio Mineria, Santiago. The station is located at Calama, and uses the slogan Radio Calama. The station's address is Casilla 1 in Calama and verification is reported to be in the form of a letter.

Dutch Commercial Station

A NEW commercial station, announced some time ago as being planned to operate off the coast of Holland on a ship especially designed for broadcasting, has now been put into regular service. The station, which will use both medium and shortwave frequencies, has started its tests using the low frequency of 1620 Kc., just off the broadcast band. The station is on the air with 1000 watts, but plans to increase this to 20,000 watts shortly and add additional frequencies. The station is a present operating from 7.00 to 9.30 p.m., 11.00 p.m. to 1.00 a.m. and 5.00 to 9.30 a.m. The identification is VRON Radio Veronica, and it is at present off Scheveningen.

DZUP Using 500 Watts

THE new Philippine station reported last issue on 7240 Kc. verified with the news that the station uses only 500 watts. Broadcasting on shortwave commenced on January 11th of this year, and relays the broadcast band station on 1580 Kc. Operated by the University of the Philippines, it broadcasts each day from 7.00 p.m. to 11.00 p.m. Power is soon to be increased to 1000 watts. The station is operated by the Electronic students at the University, and the announcers and artists are drawn from the drama sections of the school.

Berne Schedule

THE use of two new transmitter calls is now heard in the transmission from Berne in the overseas broadcasts of the Swiss Broadcasting Corporation. The two new frequencies and calls are HEU6 on 15315, and HED5 on 9545 Kc. Berne is operating in English as follows:

North America: From 11.30 a.m. on HER4 9535, HER5 11865, HEU6 15315 Kc.

North America: From 2.15 p.m. HER3 6165, HER4 9535, HER5 11865 Kc.

Eastern Australia: From 5.15 p.m. on HER5 11865, HEU6 15315, HER8 21520 Kc.

To Western Australia: From 7.00 p.m. on HER5 11865, HEU6 15315, HER8 21520 Kc.

South-East Asia: From 10.45 p.m. on HEU6 15315, HER7 17785, HER8 21520.

India Pakistan: From 12.45 a.m. on HEU6 15315, HEI9 21605 Kc.

Africa: From 12.45 a.m. on HER8 21520 Kc.

Middle-East: From 2.45 a.m. on HEU6 15315, HEI9 21605 Kc.

United Kingdom: From 4.45 a.m. on HEI3 7210, HED5 9545 Kc.

The popular DX session from Switzerland has been retimed and is now broadcast in the transmission on Tuesdays. The session for Australia and New Zealand is at 5.45 p.m., and includes DX news each second week, propagation information and replies to letters from listeners. The session has a new feature, when tape recordings from listeners are played, in which the listener tells of his DX experience in a short 4 minute recording.

FLASHES FROM EVERYWHERE

GUATEMALAN station TGJA "Radio Nuevo Mundo" has added a session in English, which is carried on the broadcasts on 5995 Kc. TGJA has a session of news and sports details in Spanish from 1.57 to 2.17 p.m. and English then to 2.27 p.m. The announcer of the English session is Jack Richards and the transmission of this nature is a daily feature.

GUINEA, one of the new African Republics, advises a North American listener that they are happy to verify correct reception reports if return postage in the form of an international reply coupon is enclosed. The station is on the air from 4.30 to 6.00 p.m. and 4.00 a.m. to 8.00 a.m. on 4910 Kc., with a further transmission from 10 p.m. to 11.30 p.m. on 7125 Kc. Reports should be sent to the Manager of Radio Guinea, Ministry of Interior, Box 617, Conokrey, Guinea.

REUNION has now returned to its old frequency of 3380 Kc. for its broadcasts from 12.30 to 1.45 p.m., 6.00 to 8.30 p.m. and from midnight to 4.00 a.m. On Sundays the transmission starts at 2.00 p.m. and concludes at 4.00 a.m. The station broadcasts in French and is located at St. Denis.

MAURITIUS has been reported by a South African reader on 6101 Kc. from opening at 1.00 p.m., to sign off at 2.15 p.m. The station broadcasts in French from 1.00 to 2.00 p.m., and then the last 15 minutes is devoted to a news bulletin in English. Reception was well received in this location, but from 2.00 p.m. suffered interference.

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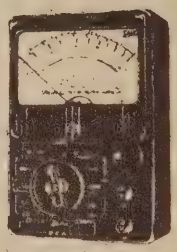

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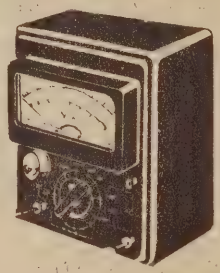

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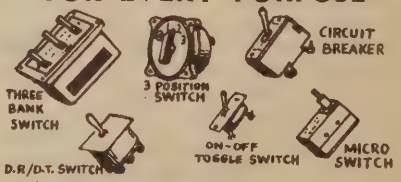

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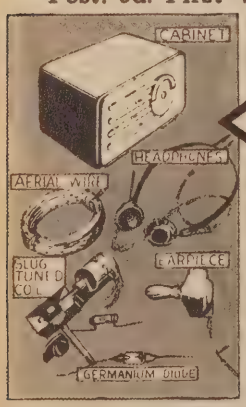

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MOZAMBIQUE station of the Aero lub has been identified on the new out- t of 2865 Kc., which takes the air 2.00 a.m. with the same program as 1 3235 Kc. From 2.30 a.m. separate ·ograms are taken, the station on 2865 c. closes down at 6.30 a.m., and the :her frequency signs at 6.00 a.m.

STANLEYVILLE in the Congo Re- ıblic is another signal heard in South frica, this station using 6079 Kc. roadcasts in French and Flemish are n the air from 4.30 to 5.35 a.m.

MONROVIAN station ELWA, which as been heard frequently in this area, reported to be good on 21535 Kc. dur- ıg the English program at 6.30 p.m.) 6.45 p.m., after which the English roadcasts give way to local languages.

BUENOS AIRES station LRX Radio Mundo has introduced a program of nglish, French and Portuguese identi- cation, in its daily broadcasts. At 9.00 .m. this is carried on 15290 and 6120 .c. and is repeated at 1.00 p.m., when ıe station uses 9660 and 6120 Kc.

ADEN has programs on 7170 Kc. in .rabic, and can be tuned from 3.30 a.m., eners in North America, and now only the Wednesday transmission is heard. This one is on the air from 11.00 a.m. to 1.45 p.m. using 21535, and 11986 Kc. It is also reported that 15180 Kc. is also used for this transmission; but a further service in English from 4.00 to 5.30 p.m. on week days and from 4.00 to 6.00 p.m. on Saturdays and Sundays is tuned on 11823 Kc.

BRAZZAVILLE informs Rodney Bailey of Newcastle, N.S.W., that they are very interested to get reports from listeners in the Pacific with the idea of introducing a transmission for this area. In the past the numerous reports from the Pacific have indicated a substantial listening audience. The station recently commenced a session for Africa, which is heard from 5.00 to 6.00 a.m. Brazzaville at this time uses 15190 Kc. The station's service to North America from 9.00 to 1.00 p.m. is reported by August Balbi in Los Angeles as being well received at his location, when using 11725 Kc.

TOKYO transmissions of Radio Japan to the West Coast of North America

RARATONGA EXTENDS SCHEDULE

BROADCASTS from ZKIZA Radio Raratonga in the Cook Islands have been extended from June 1. The broadcast is now on each Thursday from 2.30 to 4.30 p.m., and is transmitted on 4965 Kc. The station uses a power of 500 watts, and is heard during the winter months, when this band is open in New Zealand for afternoon reception. The station has also introduced a news bulletin for the last ten minutes of the transmission, this is read in English and local language, with each item being presented alternatively. The time in Raratonga for the broadcast is Wednesday from 6.00 to 8.00 p.m. The program mainly consists of request numbers, and after the National Anthem the station engineer signs off the broadcast at 4.33 p.m.

'hile at 4.00 a.m. the news in Arabic relayed from the B.B.C. London. The ation is hard to tune after 4.30 a.m., 'hen interference from Baghdad is pre- ent.

ISRAEL has dropped the use of its ew 31 metre band outlet for its English ervice and uses this only for Arabic. he English transmission on 9009 Kc. on the air from 6.15 to 6.45 a.m., nd from 2.45 to 3.15 a.m. to Africa, nd again from 7.30 to 8.00 a.m. The rabic service is now on 9725 Kc. with 189 Kc., from 2.30 to 3.15 p.m., 9.15) 10.15 p.m., and 1.30 a.m. to 7.15 a.m.

NAIROBI has been noted on 4885 nd 4950 Kc. with a relay of B.B.C. ews at 6.00 a.m. The broadcast from enya in the mornings can be heard om 3.30 to 7.00 a.m.

MONTE CARLO, which used to hange frequency during its long day perations, now broadcasts throughout on vo frequencies. The broadcasts of adio Monte Carlo are from 3.00 p.m. .00 a.m. on 7132 and 6035 Kc.

MELBOURNE'S transmission over adio Australia to the Pacific Islands as now been extended to cover Sun- ay to Friday from 12.29 to 5.30 p.m. n VLG21 using 21600 Kc. From 5.44) 7.45 p.m. daily it is on VLG11 using 1810 Kc., and from 6.00 to 8.00 a.m. n VLC15 using 15315 Kc. Radio Aus- ralia is now following the practice of dvising listeners of any sunspot activ- ties which are forecast, and advising hem of the posibilities of interference vith normal transmissions.

MONROVIA transmitter ELWA has eleted its Tuesday brodacast for list- have been switched to the 16 and 19 meter bands. The service from 3.00 to 5.00 p.m. is broadcast on 17855 and 15325 Kc., with the additional frequency 17825 Kc. being beamed to Hawaii.

LEOPOLDVILLE station Radio Leo, which has religious broadcasts, broadcasts in French from 3.00 to 4.00 a.m. on 11720 Kc. This station in the Belgian Congo has a news bulletin at 3.30 a.m.

Another Congo station on 6125 Kc. is reported to be operating from 3.45 a.m., with French from 4.00 a.m. and news in French at 4.30 a.m.

DAMASCUS in Syria is reported to be using an off band frequency for relays of its Home program. This has been heard in Europe on 5700 Kc. from 2.30 to 8.00 a.m. with the broadcasts being in Arabic.

SOUTH VIETNAM Home service is now being heard on the additional frequency of 7240 Kc. according to Radio Japan DX Hour. The station is heard with 11950 Kc. and sign off is 1.05 a.m. with the National Anthem.

MONGOLIA signals from Ula Bato are heard on 9693 Kc. and are heard from 6.00 p.m. to 2.00 a.m. This new frequency replaces the 10337 Kc. The programs are mostly in Mongolian.

TANGANYIKA is reported at good strength on its second frequency of 4785 Kc. with broadcasts from Dar es Salaam. The station is heard in South Africa from 2.00 a.m. to 5.15 a.m. daily, but on Sunday morning the service is extended to 5.45 a.m., the last part of this being dance music relayed from a hotel in the city.

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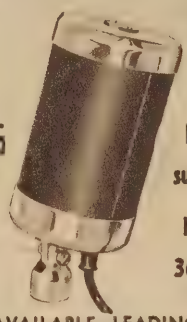

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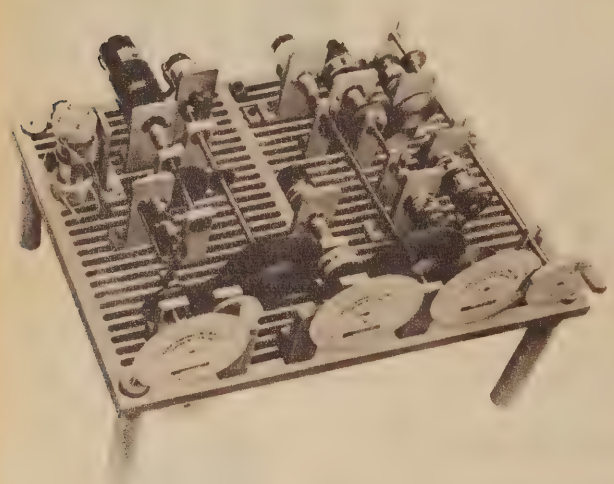

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TRANSISTOR RECEIVER

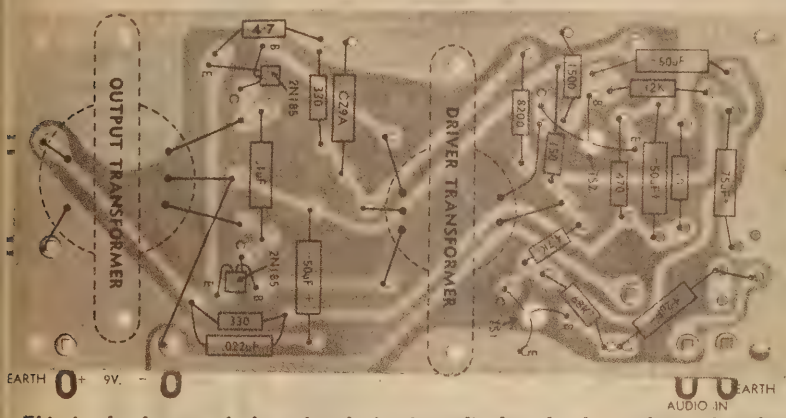
(Continued from Page 63)

The audio board may be wired and hecked separately as an initial step. ome readers will note that we have nade a small change in the bias net-ork for the output transistors since the oard was last used in the Transporta even. The result is an improvement n the reproduction at low volume.

It has been noted, during tests on his board, that if the no-signal, stand-ng collector current of the 2N185's is n the low side there will be some istortion at low level signals. This as improved in the past by increasing the audio response a little, and also makes tuning a little less critical. Any loss of selectivity appears to be purely academic.

As in any alignment set-up, an output meter of some kind is virtually essential. Most multimeters offer such facilities, as part of the AC voltage ranges, the signal being taken from across the output transformer primary. Alternatively, the signal may be taken from the transformer secondary, the meter being set to "1 mA. AC."

With the IF coils aligned we may tackle the aerial, RF, and oscillator circuits. First, see that the pointer is correctly set in relation to the gang, using



This is the layout of the printed circuit audio board. It is identical with that used for the Transporta Six and Transporta Seven.

he standing current to about 1 mA., nd achieved by reducing the forward ias resistor (from the nine volt line to he driver transformer centre tap), to bout 10K.

More recently the transistor manu-acturers have suggested that, for the N185's currently available, a better fig-re is 2 mA. (Measured at the output ransformer centre tap.) In most cases his means reducing the bias resistor o 8.2K.

NITIAL TESTS

When the whole of the set is wired nd it is switched on, there will most ikely be a loud squealing sound due o oscillation in the RF stage. This vill be apart from any effects due to reliminary misalignment. In order to lign the IF stages, which should be the rst step, it will be necessary to tempor-rily stop the RF stage from working. his is best done by removing the nega-ive supply from the RF coil.

The IF is 455 kc, and for alignment f the IF coils, the signal generator may e conveniently fed into the aerial ter-ninals. With the negative battery con-ection removed from the RF coil, plenty f signal reaches the mixer from the erial terminal through the neutralising apacitor.

Each of the two slugs in the IF trans-ormers will produce two peaks. The orrect peak is the one produced by the lug in the outside position in each ase.

These particular transformers have ver coupled coils. This means that after lignment is complete, the response hould exhibit two humps approximate-y 10 kc apart. The humps may not e very distinct but there will definitely e a flat top in evidence.

This broad response should improve any markings provided on the dial for this purpose. Then with the generator at 600 Kc, adjust the oscillator slug to produce maximum output with the pointer set to this frequency on the dial. Repeat at 1400 Kc with the oscillator trimmer.

Whilst the generator is set at 1,400 Kc adjust the neutralising trimmer for minimum audio output at the voice coil. This setting of the trimmer should be approximately correct. Now re-connect the battery supply to the RF coil and adjust the trimmer again to stop any oscillation which may be present. Try various spots across the dial, adjusting the trimmer as required, until the RF stage is stable over the whole band.

Now the alignment may be finalised, including peaking of the RF and aerial slugs at the low frequencies and peaking of the trimmers at the high frequencies. Some small adjustment may be necessary for the neutralising trimmer since there is some interaction.

SENSITIVITY

An ultimate sensitivity of between 1 and 2 microvolts for 50 milliwatts output should be attained. This is measured with a standard dummy antenna between the generator output and the aerial terminals. This figure should not be confused with the 10 uV figure previously mentioned, which produces maximum undistorted audio output.

The layout of the filter components in the AVC line is quite critical and incorrect placement of the earthing points can cause instability and oscillation. The AVC line operates at a very low impedance and any small resistances (even as low as a few ohms) in the earth returns can cause feedback. We had some initial difficulty with this prob-

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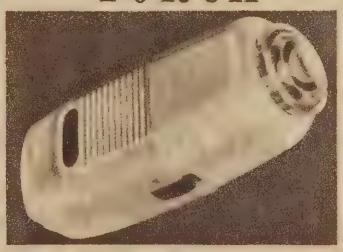

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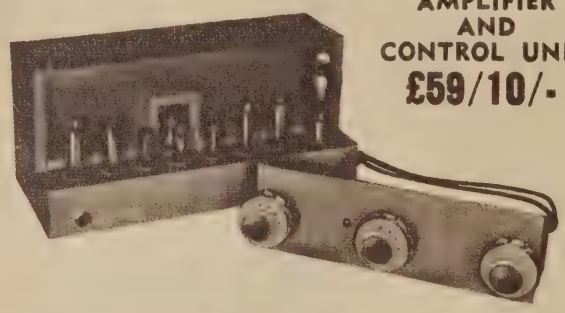

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n, but the final layout, shown in the otographs, is quite free of this trouble. e relevant components are clearly irked.

If, by chance, there is any hint of s trouble in your own receiver check e positions of the earthy ends of these mponents. However, we frankly doubt at this will be necessary.

The particular set of coils which we ve used, are mounted in aluminium ns with small plated mounting lugs etted to the base of the cans. These ils are meant to mount in a steel assis with the lugs bent over and sol-red to the underside of the chassis. Those constructors who wish to fab-ate their own chassis from aluminium, ll not be able to solder the coil lugs ectly to it. However, a perfectly sat-actory arrangement will be to bend e lugs over as tightly as possible and solder an earth strap from one of e lugs on each coil to the earth point r that particular stage. If, in addition this, tinned copper wire is used to re the coils into the rest of the cir-it, then the coil and its can will be ite rigidly fixed in place.

ERRITE ROD

A ferrite rod may be used in place the aerial coil as previously men-ned. A suitable type is manufactured Jabel and already has an aerial coup-ig coil wound on to it. It may be ounted on top of the chassis at the ck of the gang.

The results of some preliminary tests ich we have made with the rod aerial e very promising. We will have fur-er details to offer about it next month.

In the meantime we have tried it in pical suburban locations around Syd-y, using both the aerial coil and simple rials, and the ferrite rod alone. Dur-g daylight hours, the local stations ach a comfortable level with the vol-ne control barely advanced, while any country stations are clearly idible.

After sunset the dial is packed with terstate and overseas stations. Even the ferrite rod, we were able to joy several programs from New Zea-nd during the early hours of one morn-g, as well as some transmissions from rth of Australia in languages not well own to us.

In short, a set which should repro-ce almost anything audible above the evailing noise level. And that, after l, is about the ultimate order of sensi-ity for any set.

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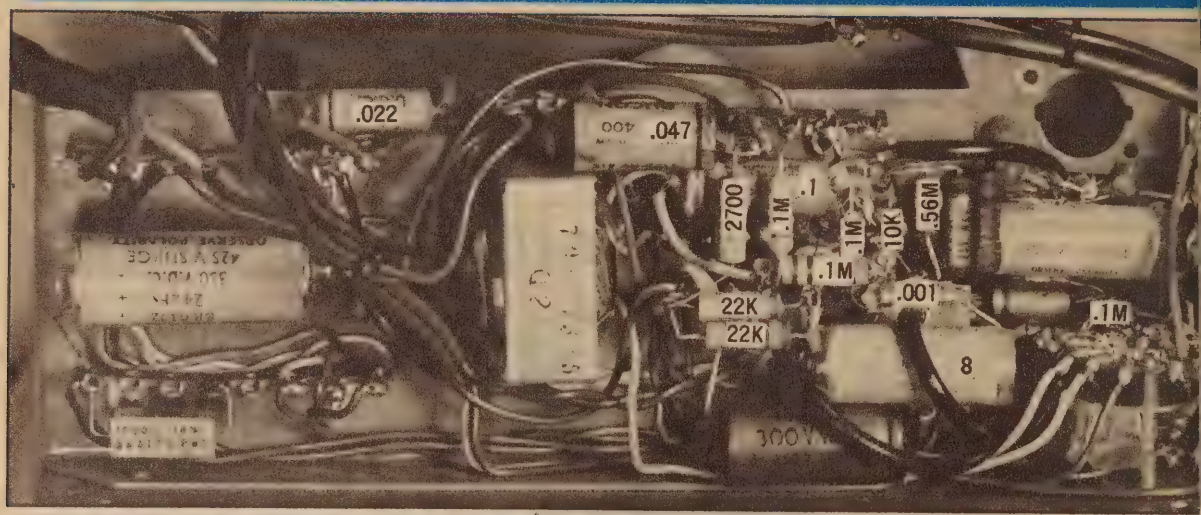


This coded underchassis picture gives a good idea of the general layout as well as the placement of the minor components. The 6BM8 socket is just visible near the top of the chassis, while the 6X4 socket is just below it, hidden by the 8 mfd electrolytic.

(Continued from Page 43)

underchassis picture. Mounted directly under the power transformer and by means of the same mounting bolts, are two eight-terminal tag strips. One of these serves to terminate the incoming power cord, the power lead from the gain control switch (a length of figure-eight plastic) and one end of the .022 mfd capacitor used to resonate the erase head. Another pair of terminals is used to terminate the output transformer secondary leads.

The other strip accommodates the HT and filament leads from the power transformer, the 1,000 ohm filter resistor in the power supply, and the positive end of the second filter capacitor.

The output transformer is mounted almost in the centre of the chassis on the underside, and adjacent to the hole which accommodates the bias oscillator coil. One mounting bolt is used to hold a three terminal tag strip (see picture, page 43). This accommodates a .047 mfd forming part of the network across the output transformer primary, and a .001 mfd capacitor, which is the grid coupling capacitor in bias oscillator circuit.

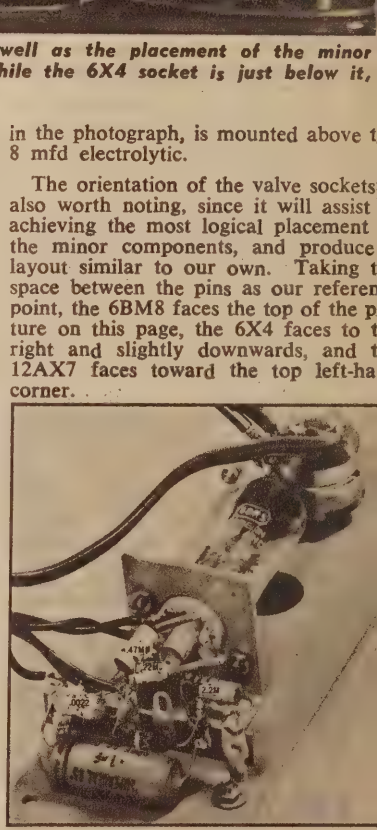
VALVE SOCKETS

Near the other end of the chassis are two valve sockets, the 6X4 rectifier and the 6BM8 triode pentode. Running between these two sockets is an eight terminal tag strip almost hidden in the photographs) which helps to support most of the minor components in the amplifier circuit proper, as well as the first filter capacitor and the 8 mfd 6BM8 screen by-pass.

Many of the components run from the eighth terminal tag strip direct to the socket pins, but a few terminate on a four terminal strip on the edge of the chassis. (See pictures, page 43.) One of these pictures gives a good view of the nearby corner of the chassis in which is accommodated the record/replay switch and the 12AX7 socket.

The socket itself is not visible in this picture, being almost hidden by the associated minor components and the switch wafers. However, its position will be obvious from the chassis layout. Along the edge of this "step" in the chassis there is a seven-terminal tag strip, while a four-terminal strip, just visible in the photograph, is mounted above t 8 mfd electrolytic.

The orientation of the valve sockets also worth noting, since it will assist achieving the most logical placement the minor components, and produce layout similar to our own. Taking t space between the pins as our referen point, the 6BM8 faces the top of the p ture on this page, the 6X4 faces to t right and slightly downwards, and t 12AX7 faces toward the top left-ha corner.



This is a view of the rear of the volume control and level indicator panel, showing all the components.

The speaker used in the original u pictured here is the Rola type 10-3 which is a 3 ohm unit. It is idea suited for this recorder, as it is extrem ly elliptical, measuring about 10 inch by 2½ inches. Designed originally f television receivers, it occupies a mi mum of space yet has a reasonat response.

This then is our latest tape record Although it is obviously not intended f the hi-fi recording crank, we feel t it will have plenty of applications everyday recording.

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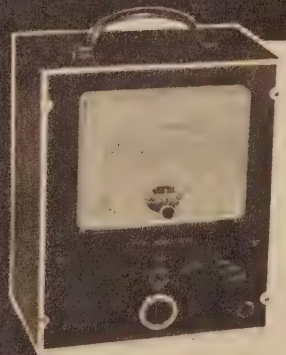

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ANSWERS TO CORRESPONDENTS

B. F. J. (Wembley, W.A.) has fitted the C compensation circuit (July 1958) to e May 1958 TV receiver and is very ippy with the results. However, he is orried as to what possible damage ight be done if the restorer valve ould fail and allow the full HT volge to be applied to the grid.

A.: Many thanks for the report B.J.F. id we are glad to learn that you are ippy with this circuit. This comment llies with all others we have heard regard to the failure of the valve, we n say that this has happened in only ie case we know of but without any idesirable effects. Naturally, it might be iwise to operate the tube under these nditions for any length of time, but e failure becomes immediately obvious driving the screen to full brightness id washing out the picture. One factor hich would tend to protect the tube the relatively poor regulation of the HT supply, the voltage of which would nd to drop as the beam current ineased. It also must be appreciated that e cathode of the picture tube already is been raised by an appreciable amount allow for the fact that the grid norally is running at a moderately high sitive potential. Thus, the failure of e control valve will not bring about big a change in grid potential as might imagined.

Our thanks for your kind remarks out the magazine and your expression sympathy. These are much apprecied.

S. D. (Beaconsfield) asks if we could plain the use and operation of a alun."

A.: We cannot spare the space in this ction of the magazine to discuss the lun, S.D., but we will file the query r possible future use in the "Answer m" section of the magazine.

D.D.F. (Bankstown, N.S.W.) writes to l us that he has seen several types of niature radios built into space ships, -planes, small plastic boxes and even ist watches. He wishes to know if we ve ever described the construction of ch equipment.

A.: Whilst we have not inspected these adios" ourselves it is fairly obvious that ey are crystal sets or at most one transtor sets. We have only featured one ally miniature set, which was the Match x Crystal Set in the March 1956 issue. ere is nothing to stop anyone building r crystal sets into any container they sire but it is necessary to remember t drastic reduction in size often results a proportionate loss of performance.

C. A. Mc. (Ballendella, Vic.) writes to l us of his experience with a tachoter made to the design suggested by J. Monotti in the December, 1959 ue. This has proved to be a very satistory instrument and C. A. Mc makes number of suggestions based on his periences.

A.: Many thanks for the report, and will certainly keep this circuit and ur suggestions in mind. In the meane your comments regarding its success uld be useful to other readers contemting this type of circuit. Many thanks o for your expression of sympathy, ich is much appreciated.

S. B. (B.C., Canada) sends us a subscription for the coming year. He also sends his greeting to various friends in the trade and says he would welcome any letters from friends desiring to exchange views and news.

A.: Thanks very much for the subscription. Also thanks for the suggestions about the mathematics course, we will keep it in mind. For the sake of friends who may care to write we are reproducing your address in full. Stanley Boyk, 1677 Cornell Avenue, Coquitlam, New Westminster, B.C., Canada.

N.B. (Hawthorn, Vic.) asks how an electric guitar pick-up operates, and also inquiries whether a crystal set used with a record player, which gives plenty of volume at the present, can be adapted for use with a ferrite rod aerial.

A.: One method of providing an electric guitar pick-up is to use steel wire in the instrument and to have small coils mounted on permanent magnets near the wires. When the wires vibrate, movement of the wires in the vicinity of the magnetic circuits causes slight variations in the amount of magnetic flux passing through the coils. This causes small voltages to be set up in the coils, according to Lenz's Law. These small voltages are amplified in the amplifier connected to the coils, and appear at the speaker as sounds.

Another way used for sound pick-ups on guitars is the use of crystal contact microphones. These consist of a crystal of Rochelle salt or similar piezoelectric material mounted so that it is in direct contact with the sounding board of the guitar. When the board vibrates, the crystal is distorted and generates a voltage which is amplified in the normal way.

The crystal set used as a simple tuner could be operated with a ferrite rod aerial if sufficient signal was available, but such aerials are very directional as you may have noticed in connection with portable radios. Thus the ferrite rod aerial may cause some embarrassment at times due to the complete record playing equipment having to be rotated, assuming you have the crystal set built in to the player.

J.M. (Auckland, N.Z.) takes us to task for saying that small one- and two-transistor sets would not work a loudspeaker satisfactorily. He says they do!

A.: There's no real contradiction here, J.M. It's just a matter of what you consider adequate volume, how much noise the sound has to compete with and how much distortion you are prepared to tolerate. If you multiply the voltage fed into the final transistor—here 1.5—by the current in milliamps, you will get the power fed into the stage. Its audio power output must be less than this; it cannot be more. And the simple situation is that two or three milliwatts of audio power is precious little to feed into a loudspeaker. Our use of a 9-volt battery in some sets was an attempt to push this figure up.

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TO assist our readers, "Radio, Television and Hobbies" conducts a technical query service. Conditions governing this service are set out below:—

(1) Requests for copies of circuits or technical queries requiring an answer through the post must be accompanied by postal note or stamps to the value of TWO SHILLINGS. Queries not accompanied by a fee will be answered in rotation on these pages.

(2) For the 2/ fee, we will supply circuit data, as available, for up to three projects. The amount of data available varies, but in no case can it include information additional to that already published in the magazine. As a rule, requests for circuits will be answered more speedily if they are clearly identified and not complicated by questions requiring the attention of technical personnel.

(3) The technical query service is aimed primarily at assisting readers in matters relating directly to articles published in the magazine. Answers will be given in note form and only so far as can be drawn from general knowledge of the relevant subject. We cannot provide lengthy answers, undertake special research, discuss commercial designs or draw special circuits.

(4) The Editor reserves the right to return query fees or to limit the scope of an individual reply, where it is felt that a partial answer will be better than none at all. Please note that the inclusion of an extra fee does NOT entitle correspondents to special consideration.

(5) In addition to the normal query service, chassis blueprints are available for most of our projects, showing the position of all holes and cutouts for metal-working but containing no details of wiring, etc. Apart from complicated projects like TV sets and oscilloscopes, most blueprints cost 5/ each. Original photographs of most projects are also available, from 5/ for a 6in x 8in glossy print; postage 9d extra.

(6) Letters should be addressed to the Technical Editor, "Radio, Television and Hobbies," Box 2728, G.P.O., Sydney.

(7) "Radio, Television and Hobbies" does not deal in radio components nor will we debate the relative merits of competitive products. Prices and specifications of merchandise must be obtained from our advertisers.

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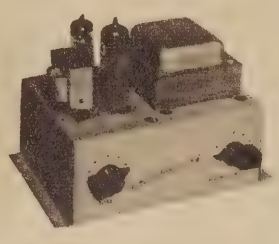

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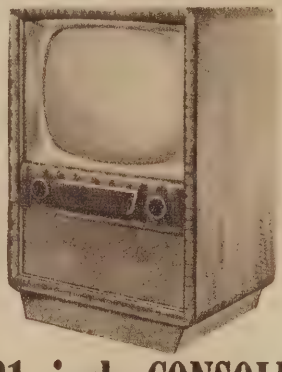

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(as illustrated)

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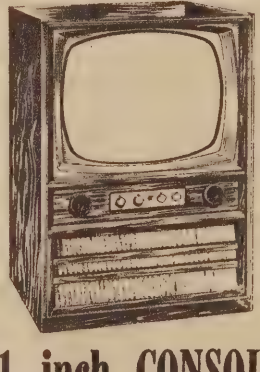

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100W. AMPLIFIER

(Continued from Page 71)

ur prototype amplifier was produced a 16-gauge steel chassis, measuring long by 10½in wide by 3in deep. ront panel is provided by sloping the t side of the chassis, and this can embellished, if desired, by the addi- of a lettered panel.

n the normal way, a chassis blueprint be made available showing the de- of holes and cutouts.

n service, a plate covers the complete erneath of the chassis while a cover ioned from perforated metal goes r the valves and transformers.

he layout of major components is e straightforward, and is shown rly in the photograph on page 31.

he placement of minor components general wiring details can be seen in under chassis picture on page 35. en mounting the valve sockets it is isable to follow our orientation, in er to duplicate the original layout.

he KT88s have the spigot keys fac- the front of the chassis, while the G7 driver has the space between pins nd 9 facing toward the microphone pickup sockets. Both the first 6CG7 the EF86 face the rear of the chas-

Otherwise the construction should be fectly straightforward, and well with- the scope of any serviceman or rea- ably experienced home builder.

However, it is suggested that care be rcised in bringing the amplifier into ration for the first time. There is ot of power available both in the ver supply, and as audio power in the put stages. A fault due to careless ing or checking could cause a lot damage.

Check all wiring most carefully before- d, and monitor the HT voltage care- y for the first few minutes of opera- . Since it is unlikely that speakers be available immediately to take the output, the power should be fed a dummy load, and the power out- measured by means of an accurate voltmeter and appropriate calcula- .

This has been covered in previous cles (see November 1959) and we can- deal with it here in detail. How- r, using a suitable load across the put transformer primary, it should possible to measure the full 100 watts, ng a 1,000 cps sine wave input.

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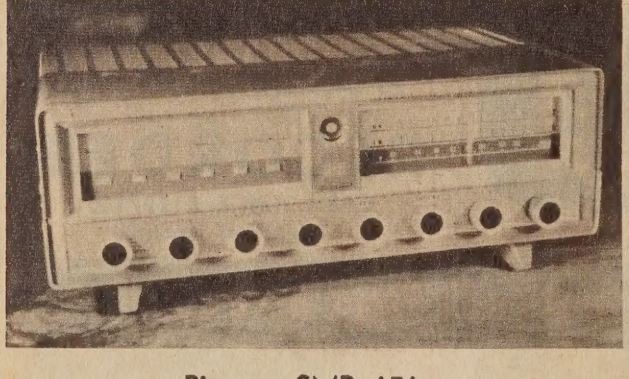

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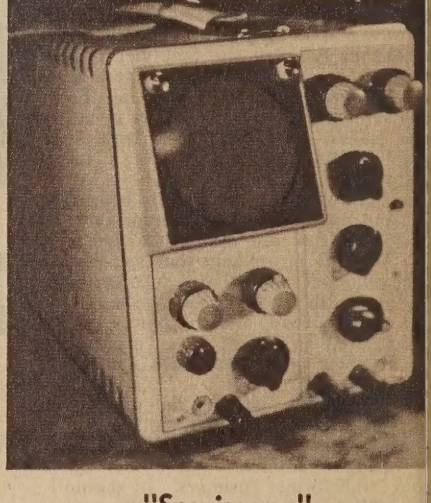

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Interior View of
Grundig FA 40 Camera

IE WORLD'S CRUST

(Continued from Page 15)

ıs, if the crust moved far enough ing polar areas over the equator, ɔlar areas would have to stretch 78 to fit themselves over the equator. ise, the parts formerly over the ɔr and now over the poles would to contract 78 miles.

evidence gathered by Hapgood does ıow a greater displacement of more 30 degrees ever having taken place, is one-third of the distance from o equator, "the average stretch per may have amounted to no more about five or six feet or one foot housand."

s stretching would, of course, be of able nature. In some places where arth's crust is weak, fissures and would occur and no actual stretch- ould take place of the actual crust. ıer places cracks and faults would together.

QUAL STRETCHING

vertheless, stretching of some sort e place and contraction in another l be inevitable.

ɔgood has pointed out that the required to stretch and fold the are by no means great. Relatively forces acting over a considerable period would be all that is required.

: unequal stretching with sinking ne places must create an uplift in er.

ıs the stretching and contraction of ust moving pole-ward and equator- creates an uplift of the crust into tain ranges and valleys.

w it might be supposed that the out- lance ice cap, pressing gently on the s crust, would not create sufficient to throw up mountains thousands les away.

James H. Campbell, collaborator ıpgood, has pointed out that while ıressure of the ice cap is respon- for the movement of the earth's it is not the force responsible for sing of mountains. He suggests that he force of gravity which does this : following manner.

CE OF GRAVITY

: ice cap slides the crust horizon- to a new location where it can be upon by the force of gravity. If rea moves towards the pole, it ar- at a place where the circumference e earth is less and therefore the ; is less.

area of earth at a place further the pole is too large for a point to the pole. Therefore, where this s moved closer to the pole, there is ıuch earth and it must go some- . So it is pulled down by gravity olds. It can do nothing else.

enlarging on this matter, Hapgood "If the reader can visualise a flat ɔn the equator which, in process of displaced with the crust as far as ɔle, has been folded enough to pro- mountains six miles high, he will understand the idea.

w, actually, the peaks of those tains are no further from the centre : earth than the flat area was at ıuator. Their altitude, with refer- :o the earth's centre, is unchanged. What has changed altitude, however, is the rest of the surface, outside the mountain chain. That has been pulled down six miles.

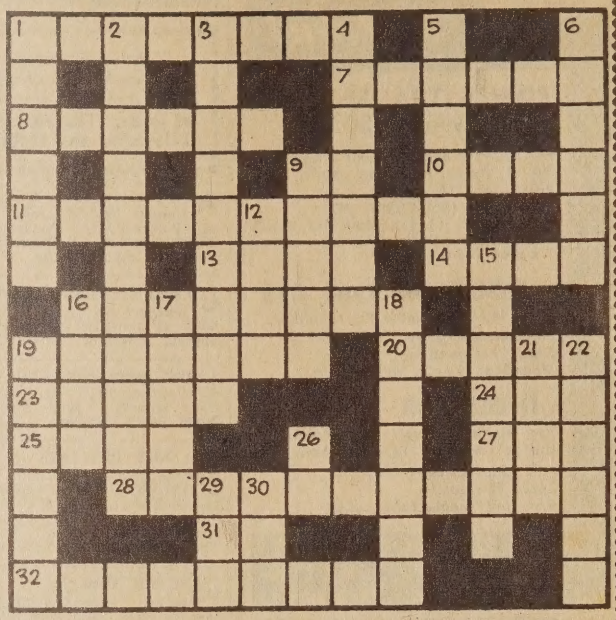
"Here then," says Hapgood, "is the answer to the long-standing enigma of the source of the energy for mountain folding. The mountains are not lifted up at all; the surface is pulled down . . . and folding results when there is an excess of surface."

SIMPLE THEORY

Hapgood's theory of the shifting crust promises to solve many of the problems of the earth which have baffled scientists for centuries. Evidence collected by Charles H. Hapgood is directed to explaining such matters as the shape of the Earth, continents and ocean basins, the cause of extinction of flora and fauna, the heat of the Earth and so on.

It is a remarkably simple theory. So simple indeed, that it is a wonder I didn't think of it myself!

THE R., TV & H. CROSSWORD No. 75



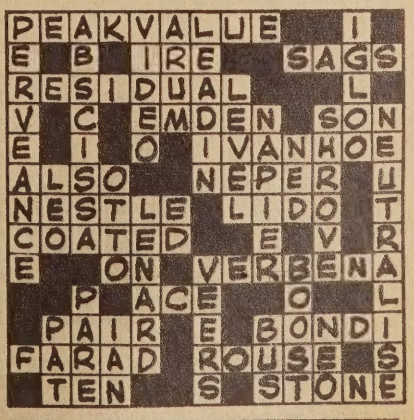
ACROSS

1. The range of grey tones between the darkest and lightest on a TV screen.
7. The ability to do work.
8. Term for two or more capacitors placed end to end.
9. Senior abb.
10. Member of an ancient race.
11. Goes beyond.
13. Amphibian.
14. Units of work.
16. Thrown out.
19. Goes round
20. Type of tube.
23. Prepares for the printer.
24. Digit.
25. Recessed opening.
27. Neon.
28. A magnetic field causes this in a conductor.
31. Short for Old English.
32. Part of a receiver that changes radio frequency into a signal that will operate an audio amplifier. (pl.)

DOWN

1. A positive ion.
2. Kind of load in which the current and voltage are in phase.
3. They can alter the value of resistance.
4. A transistor with four elements.
5. Contrive.
6. Kind of capacitor.
9. Lathers.
12. Dream for the future.
15. He discovered X-rays.
16. Drink.
17. Valued.
18. Amuses.
19. Put on tape.
21. The dawn.
22. Relaxed.
26. Kind of current.
29. Familiar term for a medico.
30. Still.

Last month's solution



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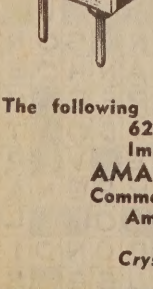

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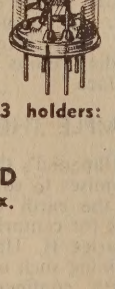

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